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BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

OFFICIAL

Strategic Petroleum Reserve: Substantial Progress Made, But Capacity And Oil Quality Concerns Remain

COMPLETED

78

During fiscal year 1981, the Government filled the Strategic Petroleum Reserve at an average rate of 292,000 barrels per day, the highest rate achieved for any fiscal year since oil fill began. This report discusses efforts since July 1980 to fill the reserve and notes that the Department of Energy will be able to maintain only an average rate of 189,000 barrels per day from fiscal year 1982 to 1989 under current expansion plans. It makes recommendations concerning the availability of storage capacity and the quality of oil stored in the reserve. It also includes matters for consideration by the Congress during the fiscal year 1983 budget process.

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DECEMBER 31, 1981

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To the President of the Senate and the
Speaker of the House of Representatives

This report concludes our work under a July 1980 request from the Chairmen and eight members of the Senate Committee on Energy and Natural Resources and the former House Committee on Interstate and Foreign Commerce (now the House Committee on Energy and Commerce). The Committees asked us to provide periodic status reports and an overall report on the administration's efforts through fiscal year 1981 to fill the Strategic Petroleum Reserve in compliance with the Energy Security Act.

The report discusses efforts since July 1980 to fill the reserve. It makes recommendations to the Secretary of Energy concerning the availability of storage capacity and the quality of oil stored in the reserve. It also includes matters for consideration by the Congress during the fiscal year 1983 budget process. In order to meet the requestors' time frame to issue the report by January 1, 1982, we did not obtain official agency comments.

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretary of Energy; the Secretary of Defense; and the Commander, Defense Fuel Supply Center.

Charles A. Bowsher

Comptroller General
of the United States

III

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

STRATEGIC PETROLEUM RESERVE: SUBSTANTIAL PROGRESS MADE BUT CAPACITY AND OIL QUALITY CONCERNS REMAIN

D I G E S T

The Federal Government's Strategic Petroleum Reserve (SPR) is vital to the Nation's efforts to protect itself against oil embargoes or temporary oil shortages. During an energy emergency the SPR's petroleum supplies would be an important addition to industry's supplies and would be used to supplement Federal and industry efforts to mitigate the effects of an interruption in the Nation's imported oil supplies.

Title VIII of the Energy Security Act (P.L. 96-294, June 30, 1980) requires the President to fill the SPR at an average rate of at least 100,000 barrels per day during each year until the reserve is filled. The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) requires that the President seek to fill the SPR at an average annual rate of at least 300,000 barrels per day.

This report follows nine status reports and concludes GAO's work under a July 23, 1980, request from members of the Senate Committee on Energy and Natural Resources and the former House Committee on Interstate and Foreign Commerce (now the House Committee on Energy and Commerce). In addition to the status reports, the committees requested an overall report by January 1, 1982, on the administration's activities to implement title VIII.

In order to meet the requestors' time frame, GAO did not obtain official agency comments on the report.

OVERVIEW OF FISCAL YEAR 1981 ACTIVITIES

During fiscal year 1981, the administration far surpassed the required minimum fill rate and almost met the higher fill goal by adding

to the SPR at an average rate of about 292,000 barrels per day. This fill rate is the highest rate achieved for any fiscal year since the oil fill began.

By the end of fiscal year 1981, the SPR contained about 199 million barrels of oil, or more than twice the 93 million barrels that were in the SPR at the beginning of the year.

The administration used a variety of methods to obtain oil during fiscal year 1981. The Defense Fuel Supply Center, the Department of Energy's (DOE's) purchasing agent for most SPR oil, acquired oil through a competitive exchange of Naval Petroleum Reserve oil and through an open continuous solicitation of oil available on the spot, or short-term, market. In addition, DOE acquired oil under a multi-year contract with Petroleos Mejicanos (PEMEX), the Mexican State oil company.

FUTURE FILL RATE CONSTRAINED BY CAPACITY

DOE's storage expansion plans provide for an average fill rate of 189,000 barrels per day during fiscal years 1982 through 1989. Although this rate will far exceed the minimum statutory requirement of 100,000 barrels per day, it falls considerably short of the 300,000-barrels-per-day fill rate goal set in the Omnibus Budget Reconciliation Act. The average fill rate could even be less if existing construction problems at some SPR sites continue or new problems cause further schedule slippage.

In July 1981, DOE reported on options for increasing the SPR fill rate. However, DOE considered only those options which increase the size of the reserve and assumed that the schedule for completing a 750-million-barrel reserve would be maintained.

GAO believes that DOE's assessment should have addressed additional options, and it questions the soundness of some key assumptions. For example, the study did not assess options for filling a smaller reserve at the 300,000-barrels-per-day rate nor other options such as leasing temporary storage.

An accelerated SPR program would have significant budget implications because, in addition to facilities' costs, oil acquisition costs would be spread over fewer years and necessitate higher funding levels in the early 1980s.

As required by the Omnibus Budget Reconciliation Act of 1981, DOE is conducting a study of the costs and benefits of the currently planned 750-million-barrel SPR and any other larger or smaller final storage capacities which might be appropriate. This study is scheduled to be completed in February 1982.

Depending on decisions on the final size of the reserve, the fill rate, and funding levels, DOE may need to alter its current capacity expansion plans. To assist the Congress in its deliberations over appropriate SPR funding levels, we believe DOE should more fully assess the costs and benefits of alternatives to its current expansion plans. The Congress may then wish to reaffirm or provide new guidance on the desired SPR fill rate.

DOE PURCHASES HEAVIER CRUDES

In the event of a drawdown, SPR crude oil must be refined into petroleum products before it is used by consumers. U.S. refineries can produce a range of products, such as gasoline, kerosene and jet fuels, heating oil, lubricants, waxes, asphalt, and coke, in descending order from lightest to heaviest. The proportion of these products varies with refinery design, market demand, and with the physical characteristics, or quality, of the crude oil used. The quality of the SPR oil, therefore, is an important determinant of the amount of specific petroleum products available to the Nation during an interruption.

DOE's original crude oil quality specifications and oil acquisition strategy were based on a 1976 assessment of refinery product needs and capabilities. DOE modified its acquisition strategy during fiscal year 1981 to accept Alaskan North Slope and Mexican crudes that are heavier than oil previously purchased, without conducting a similar

assessment. Although DOE awarded a $258,000 contract in May 1981 to perform such an analysis, the study will not be completed until August 1982. In the interim, DOE has continued to purchase lower quality oil without the needed analysis.

By December 1, 1981, 40.3 million barrels--18 percent--of the 223 million barrels of oil that the SPR had received were heavier crudes. Depending on the ultimate size of the reserve and the amount of heavier crude oil it contains, this percentage could change. Consequently, the likely impact of the heavier crudes on the mix of oil products which might be available is not known at this time.

RECOMMENDATIONS

GAO recommends that the Secretary of Energy:

--Evaluate options for achieving an average annual fill rate of 300,000 barrels per day assuming the planned and other SPR sizes. The evaluation, which should be available for fiscal year 1983 congressional budget deliberations, should assess costs and benefits of alternatives to constructing new underground storage facilities, including such options as leasing existing storage capacity.

--Emphasize crude oil quality in acquiring oil for the SPR under current specifications, to the extent that availability and prices of such crudes allow.

--Require that the Deputy Assistant Secretary for the SPR document the rationale for any future lowering of SPR oil quality specifications. Such documentation should address key reasons for the change, such as the availability and comparative costs of higher quality crude oils.

--Make a decision no later than September 30, 1982, on whether the quality specifications and acquisition strategy for SPR oil should be revised. The results of the ongoing studies of oil quality and the size of the reserve should be useful in making that determination.

MATTERS FOR CONSIDERATION BY THE CONGRESS

As part of the fiscal year 1983 budget process, the Congress should explore with the Department of Energy the matters discussed in this report regarding its current capacity expansion plans and options to achieve an average annual fill rate of 300,000 barrels per day until the SPR is filled. Based on its evaluation, the Congress should reaffirm or provide new guidance on its desired SPR fill rate.

Tear Sheet

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ABBREVIATIONS

ANS	Alaskan North Slope
API	American Petroleum Institute
DFSC	Defense Fuel Supply Center
DOE	Department of Energy
DUCI	Dravo Utility Constructors, Inc.
FEA	Federal Energy Administration
GAO	General Accounting Office
NPR	Naval Petroleum Reserve
PEMEX	Petroleos Mejicanos
SPR	Strategic Petroleum Reserve

CHAPTER 1

INTRODUCTION

The Federal Government's Strategic Petroleum Reserve (SPR) is vital to the Nation's efforts to protect itself against oil embargoes or temporary oil shortages. During an energy emergency, the SPR's petroleum supplies would be an important addition to industry's supplies and would be used to supplement Federal and industry efforts to mitigate the effects of an interruption in the Nation's imported oil supplies.

The Energy Policy and Conservation Act of 1975 (P.L. 94-163) authorized the creation of an SPR to provide for storage of up to 1 billion barrels of crude oil. To implement this program, the Federal Energy Administration (FEA) 1/ released its Strategic Petroleum Reserve Plan on December 15, 1976. This plan called for a reserve of 150 million barrels by December 1978 and 500 million barrels by December 1982. In March 1977, FEA announced the acceleration of SPR development and established more optimistic goals for filling the reserve--250 million barrels by the end of 1978 and 500 million barrels by the end of 1980.

These goals proved to be overly optimistic, and the program experienced a number of problems during its first 5 years. Construction progressed at a slower rate than anticipated because of technical problems. The cost of developing SPR storage facilities escalated because of unrealistic cost estimates, which were based on preliminary feasibility studies rather than engineering designs; accelerated construction schedules; and cost control problems. In addition, the Department of Energy (DOE) suspended oil purchases in April 1979 because of a worldwide shortage of oil during early 1979. 2/

The suspension of oil purchases continued into 1980 and as of June 30, 1980, the Government had not resumed oil purchases for the SPR. At that time, the SPR contained about 91 million barrels of oil. Although this was the equivalent of about a 2-week supply at the average 1980 crude oil import rates, the drawdown capability of the reserve was limited to about 1 million barrels per day.

In part, to encourage the Government to resume oil purchases and continue filling the SPR, the Congress passed the Energy Security Act (P.L. 96-294), which the President approved on

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1/The functions of the Federal Energy Administration were assigned to DOE on Oct. 1, 1977, pursuant to the Department of Energy Organization Act (P.L. 95-91).

2/We have been reviewing the development of the SPR since its inception and have reported on these and other issues which affected the SPR's progress. Appendix II lists our reports on the SPR.

June 30, 1980. Title VIII of the act requires the President to fill the SPR at an average rate of at least 100,000 barrels per day for fiscal year 1981 and each succeeding fiscal year until the SPR is filled. It also states that Elk Hills Naval Petroleum Reserve oil may not be sold unless the SPR is filled at an average rate of at least 100,000 barrels per day during fiscal year 1981 and succeeding years until the reserve reaches 500 million barrels. The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) requires that the President seek to fill the SPR at an average annual rate of at least 300,000 barrels per day.

On July 23, 1980, members of the Senate Committee on Energy and Natural Resources and the former House Committee on Interstate and Foreign Commerce (now the House Committee on Energy and Commerce) requested that we provide periodic status reports and an overall report to the Congress on the administration's activities between July 1980 and October 1981 to implement title VIII. (See app. I for the letter requesting these reports.) In response to this request, we issued nine reports between September 23, 1980, and October 2, 1981, on the status of SPR activities. We also provided testimony on the status of SPR activities to a subcommittee of the House Committee on Energy and Commerce on March 18, 1981, and to a subcommittee of the Senate Committee on Energy and Natural Resources on March 30, 1981.

SPR OIL STORAGE FACILITIES

DOE--the primary agency responsible for developing and operating the SPR--is implementing a three-phased program to develop a 750-million-barrel SPR. Although the Energy Policy and Conservation Act authorizes a 1-billion-barrel SPR, the administration has not decided whether the final 250 million barrels of storage capacity will be built. DOE currently is conducting a study required by the Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) on the costs and benefits of the currently planned size of the SPR and any other larger or smaller sized reserve which might be appropriate. DOE expects to complete this study by February 1982.

Phase I of the program involved developing five oil storage sites on the Gulf Coast in Texas and Louisiana with a combined storage capacity of about 250 million barrels. About 98 percent of this capacity was available for oil storage by the end of October 1981. The Phase I sites consist of a single underground salt mine and a number of underground salt caverns for storing the oil, and related systems for moving and safeguarding the oil including pipelines, pumps, wells, firefighting and security systems, and maintenance buildings. Phase I also involved constructing a Government-owned oil receiving terminal on the Mississippi River at St. James, Louisiana, and negotiating multiyear contracts with the Sun Oil Company (Sunoco) and Seaway, Inc., to use their commercial terminal facilities at Nederland and Freeport, Texas, respectively, for receiving oil which is destined for SPR storage facilities. The five Phase I storage

sites, and the terminals which initially receive oil destined for these facilities, are

--the Weeks Island and Bayou Choctaw, Louisiana, storage sites, which are connected via pipelines to DOE's St. James terminal,

--the West Hackberry and Sulphur Mines, Louisiana, storage sites, which are connected via pipelines to the Sunoco terminal, and

--the Bryan Mound, Texas, storage facility, which is connected via pipeline to the Seaway, Inc. terminal.

The locations of these storage facilities and terminals are shown in figure 1.

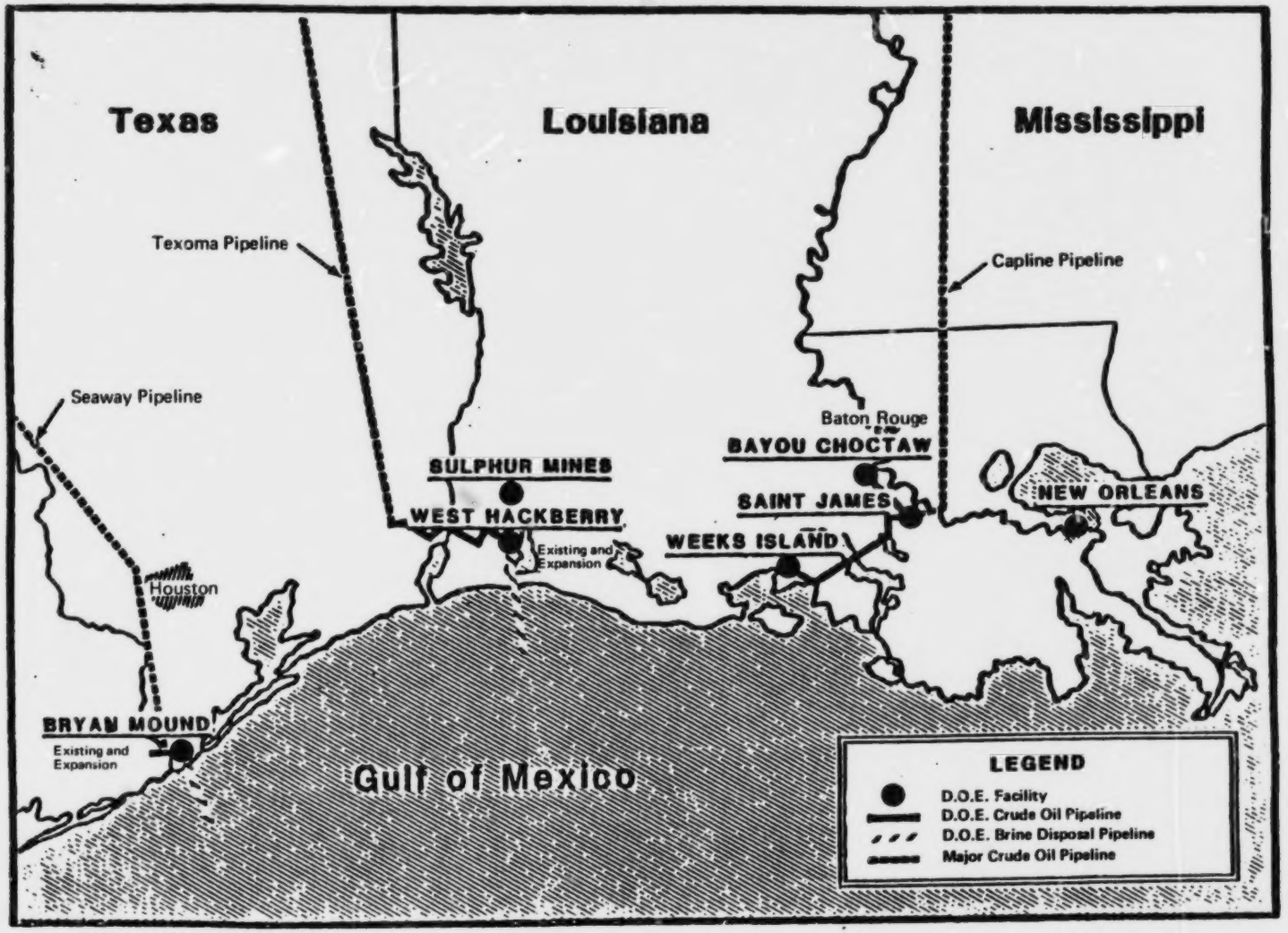
Phase II of the program started in 1979 and involves adding about 290 million barrels of storage capacity at three of the existing storage sites by the end of 1987. DOE plans to create this additional storage capacity by leaching caverns in underground salt formations--a process that involves pumping water into a salt formation and removing the salt-saturated water, or brine. The additional capacity would bring SPR storage capacity to about 540 million barrels.

DOE's current plans for Phase III involve adding a sixth storage site and expanding two existing sites to bring total SPR storage capacity by the end of 1989 to about 750 million barrels. DOE's plans indicate that the Phase III capacity would also be created by leaching caverns in underground salt formations.

ORGANIZATIONS RESPONSIBLE FOR SPR ACTIVITIES

Figure 2 illustrates DOE's organizational responsibilities for SPR activities. The Washington, D.C., SPR program office is headed by DOE's Deputy Assistant Secretary for the SPR, who reports to DOE's Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness. The Deputy Assistant Secretary is responsible for overall program management, program planning, and development and operation of the SPR. The New Orleans, Louisiana, SPR project office, which reports to the Deputy Assistant Secretary, is responsible for the day-to-day design, development, construction, and operation and maintenance of SPR facilities. This includes scheduling oil deliveries to terminals associated with SPR storage facilities, and managing about 27 contractors. These contractors are involved in operating and maintaining SPR storage facilities, installing pipelines, leaching additional storage capacity, and carrying out other construction activities associated with expansion of SPR facilities.

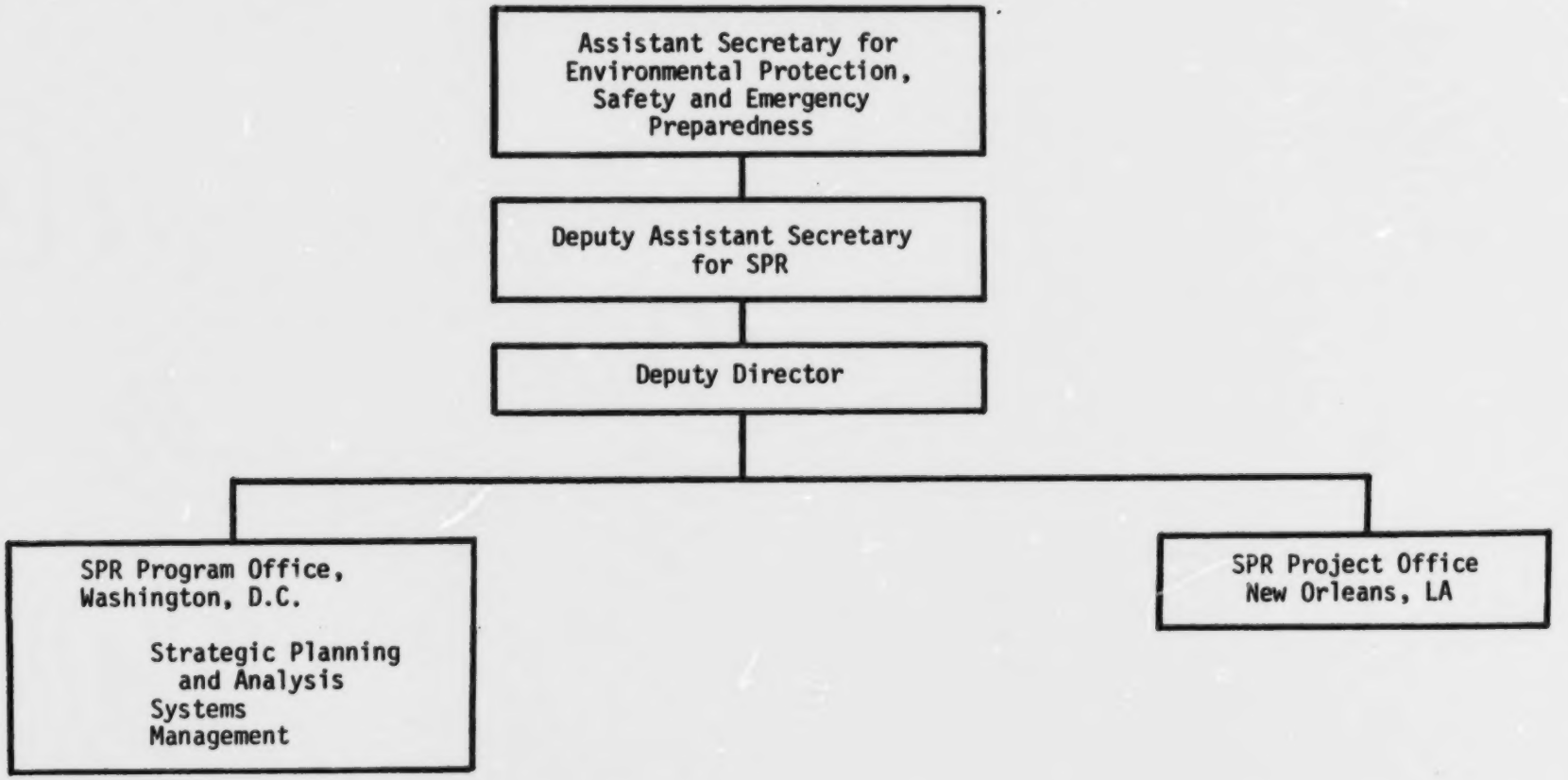
FIGURE 1
LOCATIONS OF SPR STORAGE FACILITIES AND TERMINALS



SOURCE: DEPARTMENT OF ENERGY

Figure 2

DOE Organizational Chart for SPR


Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness
Deputy Assistant Secretary for SPR
Deputy Director
SPR Program Office, Washington, D.C.
Strategic Planning and Analysis
Systems Management
SPR Project Office New Orleans, LA

Source: Department of Energy

As a result of a 1977 interagency agreement between FEA and the Department of Defense, the Defense Fuel Supply Center (DFSC) is the purchasing agent for most SPR oil. However, according to the interagency agreement, DOE can acquire oil for the SPR through contracts on a government-to-government basis. DOE initiates SPR oil procurements by issuing administrative oil acquisition orders to DFSC. These orders transfer funds and specify the volume and type of crude oil to be acquired. DFSC is responsible for issuing solicitations which request offers to sell or exchange oil for delivery to the SPR, negotiating final offers, and awarding contracts for oil deliveries.

OBJECTIVES, SCOPE, AND METHODOLOGY

This report concludes our work under the July 1980 request to report to the Senate Committee on Energy and Natural Resources and House Committee on Energy and Commerce on the administration's efforts to fill the SPR in compliance with the Energy Security Act. As agreed with the Committees' offices, the report

--summarizes the administration's fiscal year 1981 efforts to fill the SPR,

--discusses DOE's efforts to expand storage capacity and the consequent effect on the rate at which DOE can fill the SPR during fiscal year 1982 and succeeding years, and

--reviews the basis for DOE decisions concerning the quality of oil to be stored in the SPR.

Our overview of fiscal year 1981 oil fill efforts relies heavily on the nine status reports we issued to the Committees during the year. It includes a summary of fiscal year 1981 contracting efforts to purchase oil for the SPR, the availability of funds for SPR purchases, the readiness of SPR facilities to receive oil throughout the fiscal year, and the status of oil deliveries. We also obtained additional information from interviews with DFSC officials concerning oil contracts, and from DOE's SPR program office and Office of Controller, DFSC, and the Office of Management and Budget concerning the status of funds appropriated for SPR oil acquisition.

To evaluate DOE's efforts to expand storage capacity, we reviewed DOE's fiscal year 1980 and 1981 Annual SPR Reports; its November 1980 strategy for leaching Phase II caverns; its fiscal year 1982 SPR budget request dated March 10, 1981; a July 1981 study prepared for the Secretary of Energy on options for accelerating development of SPR storage capacity; and other program documents. We interviewed DOE officials in the Washington, D.C., SPR program office and the New Orleans, Louisiana, SPR project office. Our work also included on-site visits to each of the five Phase I storage sites and the three oil-receiving terminals, interviews with DOE contractors involved

in capacity expansion, and observation of meetings between DOE project officials and contractors to determine the effect on future oil fill rates of DOE's capacity expansion activities.

To evaluate the basis for DOE decisions concerning the quality of oil stored in the SPR, we reviewed the 1976 SPR Plan, a 1976 contractor report, internal memoranda, and DOE's July 1981 plan for withdrawing and allocating SPR oil. Due to the lack of documented information concerning the rationale for recent changes in the oil acquisition plan and oil quality specifications, we relied heavily on interviews with DOE and DFSC officials. We also discussed with U.S. refining industry and trade association officials the implications of the quality of oil stored in the SPR on U.S. refiners' ability to provide needed products during an oil supply interruption, and reviewed the National Petroleum Council's December 1980 report on "Refinery Flexibility".

In order to meet the requestors' January 1, 1982, time frame for the report, we did not review DOE's controls over, or verify, the volumes and quality of oil reported received, the reasonableness of prices paid for SPR oil, the performance of DOE contractors, or the administration's efforts to determine what the final size of the SPR should be. In addition, we did not attempt to determine the optimum fill rate for the SPR. However, we plan to continue reviewing SPR activities, including a number of these areas, in the next year.

Because of time constraints imposed by the request, we did not obtain official agency comments. However, we provided DOE and DFSC program officials a draft of this report prior to a meeting in which both the factual accuracy as well as the tentative conclusions and recommendations were discussed. Based on these comments we made appropriate revisions to the report.

CHAPTER 2

SPR FILLED AT AN AVERAGE RATE OF 292,000 BARRELS PER DAY

DOE estimates that, during fiscal year 1981, SPR facilities received about 107 million barrels of crude oil. These deliveries were equivalent to an average fill rate of about 292,000 barrels per day during the fiscal year, far exceeding the minimum 100,000-barrels-per-day rate required by the Energy Security Act and the administration's March 1981 budget goal of an average rate of 207,000 barrels per day during the fiscal year. In addition, the rate is close to the 300,000-barrels-per-day goal set forth in the Omnibus Budget Reconciliation Act.

This chapter summarizes the administration's SPR oil contracting and fill activities during fiscal year 1981, including the availability of funds for SPR purchases and the ability of individual sites to receive oil.

SPR OIL FILL ACTIVITIES

During fiscal year 1981, the administration used a variety of methods to obtain oil for the SPR. Initially, the administration concentrated on meeting the Energy Security Act's minimum 100,000-barrels-per-day fill requirement through the competitive exchange of Naval Petroleum Reserve oil for oil delivered to the SPR and by establishing regulations that, if implemented, would have assured that the minimum fill rate would be met by requiring companies to provide oil to the SPR if the competitive exchange did not succeed. In January 1981, the administration began to solicit offers for oil available on the "spot", or short-term, market which allowed the administration to exceed the minimum fill rate for the first time. In August, DOE signed a contract for a long-term supply of oil for the SPR with Petroleos Mejicanos (PEMEX), the Mexican State oil company, for up to 110 million barrels of oil. These efforts allowed the SPR to achieve an average fill rate during fiscal year 1981 of 292,000 barrels per day.

Fiscal year 1981 exchange of Naval Petroleum Reserve oil

During the summer of 1980, DOE began to acquire oil for the SPR through the competitive exchange of 36.7 million barrels of crude oil from the Naval Petroleum Reserve (NPR) at Elk Hills, California, for an equal volume of oil to be delivered to the SPR. DOE's authority to use Elk Hills oil for the SPR was originally set out in the Energy Policy and Conservation Act of 1975 and was restated in the Energy Security Act. The Energy Security Act also stipulates that Elk Hills oil cannot be sold or otherwise disposed of unless the SPR is being filled at the act's required minimum average fill rate of 100,000 barrels per day. Although other options were available to acquire oil, such

as an open solicitation or use of Federal royalty oil, DOE believed that using the federally owned NPR oil would guarantee availability of about 100,000 barrels per day of domestically produced oil for the SPR, present less administrative problems, and require less time to implement than using Federal royalty oil. The administration did not purchase oil on the world market, citing its June 1979 agreement to refrain from foreign oil purchases when such activities would place "undue pressure" on world oil prices.

On August 11, 1980, the Defense Fuel Supply Center (DFSC) issued a solicitation for the competitive exchange of NPR oil. On September 18, and October 1, 1980, DFSC awarded contracts for a total of about 24 million barrels, or about 65,000 barrels per day of the 100,000-barrels-per-day NPR production for which DFSC initially requested offers.

As a result, on October 3, 1980, DFSC issued a supplemental solicitation to exchange the remaining 35,000 barrels per day of NPR oil. This solicitation, however, broadened the oil quality specifications to allow companies to offer for the first time heavier Alaskan North Slope oil 1/ in exchange for NPR oil. The awards made in October 1980 under the supplemental solicitation, brought the total amount exchanged to 36.7 million barrels or about 100,000 barrels per day. (See app. III for information on the types of oil acquired, proposed delivery schedules, and prices as a result of DFSC's initial and supplemental solicitations for the NPR exchange.)

The first oil delivered as a result of the competitive exchange was received at DOE's St. James terminal on September 23, 1980; by the start of fiscal year 1981, 1.6 million barrels had been delivered. During fiscal year 1981, DOE received 34.8 million barrels under the exchange. Between the end of fiscal year 1981 and December 1, 1981, DOE received an additional 500,000 barrels under the exchange. The total volume of oil delivered under the exchange was 36.9 million barrels, or 200,000 barrels more than the amounts specified in the contracts. Deliveries exceeded contract amounts as allowed under the terms of DFSC's contracts.

Mandatory requirements to ensure minimum SPR oil fill

In addition to the NPR exchange, on January 5, 1981, DOE's Economic Regulatory Administration finalized regulations amending

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1/Heavy oil is defined in terms of American Petroleum Institute (API) gravity. API gravity is a measure of the mass of a fluid relative to water and ranges from 10 degrees for very heavy crude to 45 degrees for very light crude. ANS oil is about 26 degrees API gravity, whereas most oil accepted for the SPR has an API gravity of between 30 degrees and 44 degrees.

mandatory price and allocation controls established under the Emergency Petroleum Allocation Act of 1973 (P.L. 93-159). Those amendments would have required refiners to provide oil to the SPR if the voluntary, competitive exchanges of NPR oil did not reach the 100,000-barrels-per-day minimum requirement. However, on January 28, 1981, the President removed remaining price and allocation controls on crude oil and refined petroleum products. The removal of allocation controls effectively nullified the SPR allocation regulations related to the mandatory requirement.

Additional contracts issued to accelerate fill rate

Until January 1981, DOE directed most of its attention to meeting the minimum supply requirement of the Energy Security Act. However, on January 27, 1981, DOE's Deputy Assistant Secretary for the SPR signed an oil acquisition order which authorized DFSC to issue a solicitation for the delivery of additional oil during the fiscal year. Three days later, DFSC issued an open continuous solicitation for SPR oil. DFSC was able to quickly issue the solicitation, in part, because as early as August 13, 1980, DOE's SPR program office had requested DFSC to prepare the solicitation and be ready to issue it upon notice from DOE.

DFSC officials refer to the January 1981 solicitation as an "open continuous solicitation" because, unlike its 1980 solicitation to exchange NPR oil for oil to be delivered to the SPR, the January 1981 solicitation allowed companies to repeatedly submit offers to sell oil to the SPR, receive contracts, and submit offers to sell additional oil without DFSC readvertising the solicitation.

The solicitation invited companies to submit offers to sell oil to the SPR on a regular basis. The first cutoff date for receiving offers was February 10, 1981. DFSC uses a range of market prices paid for similar types of oils to evaluate the reasonableness of the prices offered prior to making periodic awards under the solicitation.

The solicitation requested crude oils meeting the SPR specifications and included Alaskan North Slope oil and blends of oil. It also allowed offers for a minimum quantity of 240,000 barrels of oil delivered by ship or 50,000 barrels delivered by pipeline. These offers generally involve oil available on the spot market which is available for immediate delivery.

DFSC has continued to receive offers and award contracts for delivery of SPR oil under the open continuous solicitation. As of December 1, 1981, DFSC had awarded 40 contracts to 19 companies in response to the solicitation. (See app. III for information on individual contracts.) These contracts called for the delivery of about 66.8 million barrels of oil during fiscal year 1981, and delivery of about 15.3 million barrels of

oil during fiscal year 1982. However, because of changes in delivery schedules, DOE actually received 68.1 million barrels under the open continuous solicitation during fiscal year 1981.

Initial deliveries under August 1981 Petroleos Mejicanos (PEMEX) contracts boost 1981 fill rate

In addition to oil received under the NPR exchange and the open continuous solicitation, DOE received 3.6 million barrels of oil during fiscal year 1981 as a result of an August 1981 multi-year DOE contract with Petroleos Mejicanos (PEMEX), Mexico's State oil company. The Mexican oil boosted the total oil delivered to SPR facilities during the fiscal year to about 107 million barrels, or an average fill rate of about 292,000 barrels per day for the entire fiscal year.

DOE's multi-year contract with PEMEX calls for delivery to the SPR of 6 million barrels of a heavy, high-sulfur crude oil referred to as Maya crude, and up to 104 million barrels of a blend of Maya and Isthmus, a lighter, lower sulfur Mexican crude oil. According to the contract, about 24 million of the 110 million barrels is to be delivered by December 31, 1981. After that date, DOE will receive oil under the contract at an average rate of about 50,000 barrels per day until August 31, 1986. As of December 1, 1981, DOE had received about 14.4 million barrels of Mexican oil. This included 6.5 million barrels of Maya crude, 6.9 million barrels of the blend of crudes, and 1 million barrels of Isthmus crude.

Quality specifications for the Isthmus crude indicate that it is comparable to other high-sulfur crude acquired for the SPR. Quality specifications for the Maya crude indicate it is a significantly inferior quality oil compared to other crude oils stored in the SPR. The quality of the Maya crude is discussed in more detail in chapter 4.

FACTORS CONTRIBUTING TO DOE'S SUCCESSFUL FISCAL YEAR 1981 OIL FILL RATE

DOE's achievement of a high fill rate during fiscal year 1981 was assisted by three key factors:

--The availability of sufficient funds to purchase the oil.

--A decrease in worldwide oil demand, while world production stayed relatively constant, resulting in an increase in oil supplies and a decrease in oil prices.

--The availability of DOE storage capacity and ability of terminals to handle varying receiving rates.

Funds available during fiscal year 1981

As indicated in table 1, during fiscal year 1981, about $5.3 billion was available to finance SPR oil purchases. Because of the suspension of oil purchases between April 1979 and August 1980, DOE had nearly $2.1 billion in funds appropriated in prior years available for oil purchases during fiscal year 1981. In addition, the Department of the Interior and Related Agencies Appropriation Act of 1981 (P.L. 96-514, Dec. 12, 1980) provided about $1.4 billion for fiscal year 1981 oil acquisition. Other funds also available for oil purchased during fiscal year 1981 consisted of $542 million from the sale of entitlements 1/ earned as a result of title VIII of the Energy Security Act and $1.3 billion in supplemental funds under the Supplemental Appropriation and Rescission Act of 1981 (P.L. 97-12, Jun. 5, 1981).

As of October 1, 1981, about $634 million of the total $5.3 billion available for fiscal year 1981 had not been committed for SPR oil acquisitions. DOE had transferred about $609 million of the remaining funds to DFSC which are available for fiscal year 1982 oil purchases. During fiscal year 1981, DOE requested and received congressional approval to reprogram $25 million of oil acquisition funds to pay two separate settlements associated with acquiring land for Phase I facilities. DOE reprogrammed $18 million in June 1981 for a settlement on the Bryan Mound site and $7 million in September 1981 for a settlement on the West Hackberry site.

Under the October 1, 1981, joint continuing resolution for fiscal year 1982 (P.L. 97-51), DOE was provided an additional $2.68 billion for SPR oil fill. These funds were placed in an off-budget SPR oil acquisition account established by the Omnibus Budget Reconciliation Act of 1981. According to the act, these off-budget funds are not to be counted in the Government's total expenses for the fiscal year. However, similar

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1/The entitlements program was designed to distribute the benefits of price controls on domestic crude oil among refiners. An entitlement was the right to refine a barrel of price-controlled domestic oil. Refiners bought and sold entitlements, calculated monthly by DOE as the difference between the average price of controlled and uncontrolled oil adjusted by volume of each category of oil sold, to permit them to process their monthly volume of controlled oil. The program required refiners who processed more than the national average of controlled oil to buy entitlements from refiners who processed less than the national average. Cash received in exchange for entitlements sold in effect reimbursed refiners who were selling entitlements for part of the higher purchase cost of uncontrolled oil. The entitlements program ended as a result of the President's January 28, 1981, decision to decontrol oil.

Table 1

Fiscal Year 1981 Funding for SPR Oil Acquisitions

(billion)

Funds available for fiscal year 1981:		
Prior years' funds		$2.093
Fiscal year 1981 appropriations		1.383
Entitlements (earned on fiscal year 1981 deliveries prior to decontrol on January 28, 1981)		.542
Fiscal year 1981 Supplemental Appropriations		1.305
Total funds available for fiscal year 1981 oil purchases		5.323
Fiscal year 1981 contracts:		
Competitive exchange (36.6 million barrels)	$1.441	
Open continuous solicitation (79.1 million barrels) (note a)	2.815	
PEMEX purchase	b/ .433	
Total value of fiscal year 1981 contracts		4.689
Oil funds reprogrammed for SPR land settlements (note c)		.025
Total fiscal year 1981 commitments		4.714
Fiscal year 1981 funds remaining for oil purchases		$ .609

a/As of October 1, 1981, about 12 million barrels of oil had been purchased under the solicitation for fiscal year 1982 delivery, at a total price of about $418 million.

b/According to DOE officials, these funds have been obligated to procure oil under the contract through October 31, 1981. The funds were transferred to the SPR project office in New Orleans, Louisiana, which is the contract administration office for the PEMEX contract.

c/As of October 1, 1981, DOE had received congressional approval to reprogram about $18 million of fiscal year 1981 oil acquisition funds for a settlement resulting from DOE's condemnation of land for the Bryan Mound site and about $7 million for a similar settlement on West Hackberry land.

Source: Department of Energy, Defense Fuel Supply Center.

to on-budget items, the U.S. Treasury will continue to borrow funds to finance such outlays.

On December 23, 1981, the President signed Public Law 97-100, the Department of the Interior and Related Agencies Appropriation Act of 1982. The act provides about $3.68 billion for fiscal year 1982 SPR oil acquisitions.

Together with the $609 million of fiscal year 1981 SPR oil acquisition funds which were not committed as of October 1, 1981, the $3.68 billion fiscal year 1982 appropriations bring total funds available to date, to $4.29 billion. According to DOE estimates, at $39 per barrel including transportation costs, these funds would allow DOE to purchase about 110 million barrels of oil during fiscal year 1982 and would support a fill rate of about 300,000 barrels per day if all oil purchased in fiscal year 1982 were delivered in the same year. However, according to DOE officials, they plan to spend about $1.4 billion for advance purchases for fiscal year 1983 deliveries.

Drop in world oil prices

The Government was able to achieve an average 292,000 barrels-per-day SPR oil fill rate during fiscal year 1981 in part because a drop in world oil prices made it economically advantageous. About 39 million barrels, which is over one-half of the 67 million barrels of oil acquired on the spot market during fiscal year 1981 was purchased during February 1981 and March 1981. This occurred after spot market prices for various types of crude oil dropped $2 to $4 per barrel from prices for similar crude sold during the first week of January 1981. The Government's largest, single day purchase of oil on the spot market since the beginning of the program came at the end of these 2 months, when on March 31, 1981, the Government purchased 22.4 million barrels of oil.

As a result of the lower prices, in its mid-year report to the Congress on the fiscal year 1982 budget request, the administration decreased its projection of the average fiscal year 1981 and 1982 oil purchase price by $2.50 per barrel. In that report, the administration announced that to take advantage of decreasing world oil prices, it planned to buy about 28 million barrels more than the 75.6 million barrels needed to achieve the 207,000 barrels-per-day fiscal year 1981 fill rate shown in its March 10, 1981, budget proposal. By the end of the fiscal year, DFSC had purchased about 30 million barrels of oil more than needed to achieve the budgeted fill rate.

Phase I receiving and storage capacity

During fiscal year 1981, DOE had storage capacity available to receive an average 292,000 barrels per day at each of its five Phase I storage sites. Although the Bryan Mound, West Hackberry, and Bayou Choctaw sites had been partially filled with oil prior to the suspension of SPR oil purchases in April 1979, storage space was available at these sites when DOE received the first delivery of NPR exchange oil on September 23, 1980. DOE also completed preparing and testing the Weeks Island site in November 1980 and a 6.7 million barrel cavern at Sulphur Mines in July 1981. DOE completed retesting the 8 million barrel cavern involved in the September 1978 fire at West Hackberry in July 1981. Because capacity was available at each of the storage sites, DOE also was able to receive oil through each of the three terminals during fiscal year 1981.

DOE's SPR oil fill rate is also affected by the sulfur content of oil being delivered. DOE segregates the oil stored in SPR facilities so that low-sulfur oils are stored in certain caverns and high-sulfur oils are stored in other caverns and the salt mine. In addition, low- and high-sulfur oils are not transferred through a pipeline at the same time.

As of October 1, 1981, DOE had designated about 63 percent of its Phase I capacity to store high-sulfur crude oils. This includes the 75 million barrel Weeks Island facility, 36 million barrels of capacity at West Hackberry, the total 26 million barrels of capacity at Sulphur Mines, and about 26 million barrels of capacity at Bayou Choctaw.

SPR oil fill rates varied from about 125,000 to 190,000 barrels per day between October 1, 1980, and the end of March 1981 when DOE was primarily using the Seaway and Sunoco terminals to deliver low-sulfur oil to Bryan Mound and West Hackberry and the St. James terminal to deliver high-sulfur oil to Weeks Island. After DOE began receiving oil as a result of the NPR exchange and the January 1981 open continuous solicitation, the average oil fill rate increased to between 375,000 and 513,000 barrels per day each month until the end of the fiscal year. Between October 1, 1981, and December 1, 1981, DOE received oil at an average rate of 305,000 barrels per day. (See app. III.)

Although DOE made sufficient capacity available during fiscal year 1981 to receive oil at an average rate of 292,000 barrels per day, DOE has experienced delays in bringing on-line the 26-million-barrel Sulphur Mines capacity. In our November 1980 SPR status report, we noted that DOE officials stated that this facility would be ready for oil fill during December 1980. DOE officials later changed the facility's estimated availability date to July 1981. DOE completed testing of a 6.7 million barrel cavern during July, but did not complete work on another 5.9 million barrel cavern until September 1981. DOE also has revised

the estimated date for completing work on the site's remaining 13.1 million barrel cavern to January 1982. According to DOE officials additional time was needed to locate and repair leaks detected in wells and to plan and conduct tests at the 13.1 million barrel cavern.

CHAPTER 3

DOE CAPACITY EXPANSION PLANS

Under existing storage expansion plans, DOE will not have sufficient storage capacity available during fiscal year 1982 to receive oil at 300,000 barrels per day. The 199 million barrels of oil in the ground as of September 30, 1981, plus the 110 million barrels needed to maintain an average 300,000 barrels-per-day fill rate would bring the SPR oil inventory at the end of fiscal year 1982 to 309 million barrels. This is about 42 million barrels more than DOE estimates it will have the capacity to receive.

The availability of SPR storage capacity is an issue we have addressed in several monthly SPR status reports and one requiring DOE's constant attention. In our February report, 1/ we stated that due to capacity constraints, DOE would not be able to sustain a fill rate of 300,000 barrels per day beginning in June 1981 for more than about 1 year. We recommended that the Secretary of Energy ensure that adequate capacity is available on a timely basis to meet the need of accelerated fill efforts. In addition, we recommended that the Secretary report to the Congress on the costs, advantages, and disadvantages of an accelerated construction program and other storage options.

The Omnibus Budget Reconciliation Act of 1981 states that the President shall seek to fill the SPR at an average annual rate of at least 300,000 barrels per day until the SPR oil inventory reaches 750 million barrels. However, DOE's current plans to create and fill 750 million barrels of storage capacity by the end of fiscal year 1989 allow for an average rate of only 189,000 barrels per day during fiscal years 1982 through 1989.

CREATING CAVERNS--WHAT'S INVOLVED

Creating new storage caverns involves a three-stage process of drilling wells, testing these wells for pressure losses, and leaching--injecting water into underground salt formations and removing the salt-saturated water, or brine. Wells, which are used for leaching, oil fill, and oil withdrawal, are drilled through sand and rock into the salt formation. These wells are lined with steel casings which are set in concrete to set off fresh water beds and other formations. After a well's casing is tested for pressure leaks and found to have none, a well is certified and leaching begins.

1/"Status of Strategic Petroleum Reserve Activities--February 1981" (EMD-81-19, Feb. 24, 1981).

DOE plans to keep the caverns filled with varying proportions of brine and oil during the leaching process. As a cavern grows, the volume of oil that can be injected increases. During the initial stages of leaching, which include developing the central core, or chimney, of the cavern; the bottom, or sump, of the cavern; and the cavern's roof, only about 250,000 barrels of oil, or about 555 barrels per day, are injected into the cavern. Based on DOE's leaching plan, these stages are generally completed within about 450 days after leaching begins. To expand the cavern, DOE then leaches from the roof to the bottom of the cavern. During these stages of leaching, DOE injects an average of about 20,000 barrels of oil per day.

DOE's brine disposal rate and the rate at which DOE can inject water into new caverns at Bryan Mound and West Hackberry are key factors affecting the leaching rate. DOE estimates that, for every barrel of capacity created, it must inject seven barrels of water and remove seven barrels of brine. Electric pumps are used to obtain water from a nearby river, lake, or canal and inject the water into a cavern. Incoming water forces brine within the cavern to the surface, where it is temporarily kept in man-made storage ponds. The brine is then disposed of using pumps and pipelines to either the Gulf of Mexico or underground brine wells within limits allowed by environmental permits.

STATUS OF PHASE I AND II STORAGE CAPACITY

As of December 1, 1981, DOE had ready for oil fill about 245 million of the total 258 million barrels of Phase I storage capacity. A total of about 223 million barrels of oil were in storage as of that date. (App. III provides additional information on the volume of oil in SPR facilities.) The remaining Phase I capacity that is not available for storage at this time is a 13 million barrel Sulphur Mines cavern which was discussed in chapter 2.

Phase II involves creating and filling a total of 29 new storage caverns, each with a 10 million barrel capacity, by October 1987. Twelve new caverns will be created at Bryan Mound, 16 at West Hackberry, and 1 at Bayou Choctaw. Phase II leaching began in March 1980 and, as of December 1981, has created about 44 million barrels of cavern capacity which allowed DOE to store about 7 million barrels of oil. The first Phase II cavern is scheduled to be completed in December 1982. As of December 1, 1981, DOE's operations, maintenance, and leaching contractor, Dravo Utility Constructors, Inc., (DUCI) had leached about 34 million barrels of Phase II capacity at Bryan Mound and 10 million barrels of Phase II capacity at West Hackberry. Leaching at Bayou Choctaw is expected to begin by May 1982.

DUCI's contract expires January 17, 1982, and a new contractor will assume responsibility for operating, maintaining, and expanding SPR facilities. As of December 1, 1981, DOE had

completed evaluating proposals for the new contract from eight companies and had selected Petroleum Operations and Support Services, Inc., of Houston, Texas, to replace DUCI. The final terms of the new contract are being negotiated. DOE officials expect to finalize the new contract before DUCI's contract expires and to make a transition to the new contractor without affecting Phase II activities. It is too early to tell how the change in contractors will affect the rate at which Phase II caverns are leached.

According to DOE's July 1981 expansion schedule, it plans to have 267 million barrels of capacity available for oil fill by the end of fiscal year 1982. This would allow a fill of about 68 million barrels or an average of about 186,000 barrels per day during fiscal year 1982--far short of the fiscal year 1981 average 292,000-barrels-per-day rate. It also represents the smallest increase in capacity for any fiscal year on the schedule--a 22 million barrel increase over capacity which was available for fill as of December 1, 1981. This compares with an average 69 million barrels of capacity to be added in succeeding years. Therefore, if the schedule is to be met, it will most likely be met in fiscal year 1982.

DOE officials believe that the expansion schedule is conservative. However, DOE has experienced delays in preparing caverns for oil fill, which we documented during the last year, and has recently experienced leaching problems at both Bryan Mound and West Hackberry, which are discussed in more detail in the following sections. Further, it is uncertain what effect a change in contractors will have on the schedule. If leaching problems continue or new problems arise in bringing a new contractor on board, DOE's schedule could be adversely affected.

Table 2 provides additional information on DOE's expansion goals for fiscal years 1982 through 1989 and the corresponding maximum oil fill rate which would be allowed by expansion plans. Between October 1, 1981, and September 30, 1989, DOE will be able to achieve an average fill rate of 189,000 barrels per day under its current expansion plan. The rate that DOE will be able to receive oil during each fiscal year varies from a low of 107,000 barrels per day in fiscal year 1985 to a high of 225,000 barrels per day in fiscal year 1986. DOE's oil fill capability during each year varies because of the number of Phase II and Phase III caverns in different stages of leaching during each fiscal year.

Bryan Mound status

As stated earlier, the rate of brine disposal affects the leaching rate. At Bryan Mound, DOE initially acquired 19 raw water and brine disposal pumps to leach at an average rate of 680,000 barrels per day. During fiscal year 1981, DOE requested and received approval from the Environmental Protection Agency and Texas to increase the average brine disposal rate at Bryan Mound from 680,000 barrels per day to 980,000 barrels per day.

Table 2

DOE Expansion Goals and Fill Based on

July 1981 Expansion Schedule

Fiscal year	Storage capacity available at end of fiscal year (millions of barrels)	Annual daily oil fill rate during fiscal year
1982	267	a/ 186,000
1983	343	208,000
1984	417	203,000
1985	456	107,000
1986	538	225,000
1987	611	200,000
1988	670	162,000
1989	750	219,000
Average		189,000

a/GAO calculation based on DOE's goal of filling 267 million barrels of available storage capacity by the end of fiscal year 1982.

Source: SPR Acceleration Report to the Secretary, July 1981, Strategic Planning and Analysis Division, SPR Office.

By January 1, 1982, DOE expects to have 9 additional pumps installed at the site and to begin leaching at the higher rate.

However, since July 1980, DOE has experienced problems with its 15-mile brine disposal pipeline to the Gulf of Mexico which, if not corrected, could prevent DOE from attaining the full leaching rate of 980,000 barrels per day. The problem involves excessive resistance to brine flowing through the pipeline. Normally, as brine moves through the pipeline toward the Gulf of Mexico, away from the pumps at the site, the pressure of brine within the pipeline decreases. DOE estimates that at a flow rate of 680,000 barrels per day the pressure should drop by about 130 pounds per square inch. Between March 1981 and August 1981, DOE's contractor, Jacobs/D'Appolonia Engineers, tested the pressure at three locations along the pipeline and measured an additional unexplained 40 pounds per square inch pressure drop, but has not identified the location or cause of the problem.

According to DOE officials, the pressure problem indicates brine is not flowing freely at one or more points within the pipeline. Based on the contractor's August 1981 report, DOE estimates that until the problem is solved, even with the additional pumps it plans to have operational by January 1982, DOE will be able to achieve an average of only 900,000 barrels per day. DOE's Phase II expansion schedule, however, is contingent, among other things, on achieving a 980,000-barrels-per-day brine disposal rate at Bryan Mound.

DOE project officials are now considering cutting and examining sections of the pipeline to understand and identify a solution to the problem. However, this is only the first step to solving the problem and it is uncertain when DOE will achieve the 980,000-barrels-per-day brine disposal rate.

West Hackberry status

At West Hackberry, DOE acquired 42 water and brine disposal pumps to leach new caverns and built a 27-mile brine disposal pipeline to the Gulf. According to DOE, the pumps and the pipeline will allow a 1.1-million-barrels-per-day disposal rate. DOE started leaching four of the eight Phase II caverns between May 27, 1981, and June 2, 1981. A fifth cavern was started on July 24, 1981. As of December 1, 1981, leaching of the remaining three caverns had not started.

DOE has also encountered problems in its leaching of Phase II caverns at West Hackberry which have prevented it from starting to leach the remaining three of eight Phase II caverns or from achieving a 1.1-million-barrels-per-day brine disposal rate on the five active caverns. Prior to August 23, 1981, incorrect installation of electric equipment needed to operate the site's water and brine disposal pumps limited the leaching rate at the site to about 465,000 barrels per day.

On August 23, 1981, DOE stopped leaching for about 10 days to correct the electrical problem. When leaching resumed, DOE found that wells associated with four of the five caverns had become plugged with insoluble minerals. Wells for the four caverns were unplugged during September and October 1981, and leaching resumed.

During November 1981, the brine disposal rate at the site averaged about 522,000 barrels per day because of problems DOE was experiencing in disposing of the insoluble minerals. DOE will limit leaching to this rate until January 1982 when it expects to complete construction of additional storage ponds for the minerals. DOE expects that it will then be able to increase the disposal rate to 1.1 million barrels per day.

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If the problems discussed above continue at Bryan Mound and West Hackberry and/or start-up problems occur with the new contractor, they could affect DOE's ability to achieve its Phase II expansion schedule and the fill rates which are dependent on achieving the schedule. While achieving the fiscal year 1982 expansion schedule may not be as difficult because of the lower expectations for capacity additions, problems which are not solved or new problems which arise could affect DOE's overall ability to meet its expansion schedule. If so, the fill rates shown would not be achieved unless other actions are taken. Options for increasing the fill rates are discussed on pages 25 to 31.

STATUS OF PHASE III EXPANSION ACTIVITIES

DOE's Phase III plans involve acquiring and developing a completely new 140 million barrel site and expanding capacity by 30 million barrels at West Hackberry and 40 million barrels at Bryan Mound.

Developing a completely new SPR storage site, such as the planned 140 million barrel site, tentatively selected at Big Hill, Texas, involves environmental analysis, engineering design, and construction activities. The required actions are

--performing environmental impact assessments required by the National Environmental Policy Act of 1969;

--obtaining environmental and construction permits to build oil fill and brine disposal pipelines at the site and to operate the site;

--acquiring land for the site, a brine disposal pipeline, and an oil fill pipeline;

--procuring well casing, pumps, drilling equipment, and pipelines; and

--drilling wells; installing water, brine, and oil pipelines; leaching caverns; and filling with oil.

These actions, while required for a new site, are not all required for expansion of existing sites. At West Hackberry, DOE will need to acquire some additional land before it can begin leaching, but it will not need to build additional oil fill and brine disposal pipelines. At Bryan Mound, DOE can begin Phase III by obtaining well drilling equipment, since it does not need to acquire additional land.

Phase III funding requirements

DOE's Phase III expansion would be a major additional cost for the program. In its March 1981 budget for fiscal year 1982, DOE estimated that it will cost about $1 billion to develop the 210 million barrel Phase III storage capacity. This compares with DOE estimated costs of about $1.6 billion for both Phases I and II. According to DOE officials, the cost estimate for Phase III activities is proportionately higher than the estimate for Phases I and II because of the effects of a 10-percent inflation rate compounded each year through 1989.

DOE's fiscal year 1982 appropriation legislation provides about $99 million for Phase III to continue design, begin land acquisition, and acquire drilling equipment. Further development of Phase III sites will require continued funding in fiscal year 1983 and subsequent years. DOE's ability to meet its Phase III expansion schedule is dependent, in part, on the amount the administration decides to request for such activities in the fiscal year 1983 budget.

DOE's current Phase III schedule for existing sites

Assuming fiscal years 1982 and 1983 funding for well drilling at Bryan Mound and land acquisition at West Hackberry, DOE's current Phase III schedule for these sites is as follows:

	Leach		Fill	
	Start	Finish	Start	Finish
Bryan Mound	Sept. 1983	Feb. 1986	Sept. 1984	Oct. 1986
West Hackberry	Aug. 1984	Sept. 1987	Aug. 1985	Mar. 1988

DOE officials believe the above dates are achievable at these sites because major construction is not involved, and land acquisition is required only at West Hackberry. However, as stated earlier, DOE is experiencing numerous problems with Phase II leaching at these sites, and similar or new problems could also affect DOE's ability to meet its Phase III schedule.

New storage site development

Environmental analysis and permits, land acquisition, design, and major construction are needed if the proposed Big Hill site is to be added to the SPR. Table 3 shows DOE's proposed schedule for developing the site assuming continued funding for these activities.

Table 3

Big Hill Project Summary Schedule

	Start	Completion
Planning		
Environmental Impact Statement	Oct. 1980	Nov. 1981
Permits	-	Oct. 1984
Land Acquisition		
Site	Oct. 1981	Oct. 1982
Pipeline	-	Apr. 1984
Detail Design	Sept. 1981	May 1983
Construction	Oct. 1982	Oct. 1985
Leaching	Oct. 1985	Feb. 1989
Oil Fill	Nov. 1986	Oct. 1989

Source: DOE's July 1981 Phase III expansion schedule.

During July 1981, DOE's Energy System Acquisition Advisory Board approved procurement of pumps, pipeline, and other equipment associated with the site, contingent upon completion and approval of an environmental impact statement. This statement was published during October 1981. An architectural/engineering contract was awarded in September 1981. However, major capital commitments, such as land acquisition, have not yet been made.

According to DOE's July 1981 schedule for developing the site, land acquisition is to be completed in October 1982. Oil fill at the site is to begin during November 1986. The project schedule indicates that the January 1983 target date for drilling wells at the site and the October 1985 target date for leaching are critical to meet this oil fill date.

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DOE is conducting a study required by the Omnibus Budget Reconciliation Act of 1981 to assess the costs and benefits of the currently planned 750-million-barrel SPR and any other larger or smaller final storage capacities which might be appropriate. DOE is evaluating storage capacity levels ranging from 580 million

to 1.25 billion barrels. However, this study is scheduled to be completed in February 1982 after the administration submits its fiscal year 1983 budget request. Thus, any revisions to DOE's Phase III plans that might be proposed in the fiscal year 1983 budget were developed without benefit of any completed analysis.

OPTIONS FOR ACCELERATING SPR EXPANSION

Under its current plans for Phase II and Phase III expansion, DOE will not be able to fill the SPR at the 300,000-barrels-per-day rate goal set forth in the Omnibus Budget Reconciliation Act of 1981 during fiscal year 1982 or any of the succeeding fiscal years before a 750-million-barrel SPR is filled. In July 1981, DOE completed an assessment of alternative approaches to increase its capacity to receive oil during the 1980s. The options included in this study each affect, to varying degrees, the size and cost of the SPR. Key assumptions of the study are that Phase II and III activities to create a 750-million-barrel reserve will be completed as currently planned, by the end of fiscal year 1989, and that activities to provide additional capacity would begin on October 1, 1981. The study did not assess options for filling a smaller reserve at the 300,000-barrels-per-day rate nor other options, such as leasing existing temporary storage capacity.

While we did not assess during this review what the final size nor the optimum fill rate of the SPR should be, in June 1979 1/ we pointed out that a number of factors need to be considered in determining the appropriate size of the reserve. These factors include future domestic oil supplies and demand for foreign oil, the magnitude and duration of a potential interruption in foreign oil supplies, and the effectiveness of other programs or activities which could serve to mitigate the impact of an interruption. The June 1979 report and a September 1981 report 2/ note that actions such as fuel switching, drawdown of industry supplies, demand restraint, and increase in domestic production could be used to supplement the SPR. Our September 1981 report concluded that the administration has not developed effective programs or policies in these areas to supplement the SPR and counteract the effects of a supply interruption.

The Omnibus Budget Reconciliation Act of 1981, which established the 300,000-barrels-per-day fill rate goal, authorized $60 million more for program planning, management, and facilities development than the $199 million requested by DOE for these activities during fiscal year 1982. DOE's request was based on

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1/"Factors Influencing the Size of the U.S. Strategic Petroleum Reserve" (ID-79-8, June 15, 1979).

2/"United States Remains Unprepared for Oil Import Disruptions" (EMD-81-117, Sept. 29, 1981).

its budgeted fill rate of 230,000 barrels per day. According to the Conference Report on the act, the additional authorization was to assure that sufficient funds would be available to accelerate acquisition and construction of storage capacity. However, no further information was provided concerning the use of these funds. Currently, it does not appear that DOE will receive even the funds requested to support its expansion plans. DOE's fiscal year 1982 appropriation under the Department of the Interior and Related Agencies Appropriation Act of 1981 provides 4 percent less than the $199 million requested. According to DOE officials, additional funds would be needed to build or lease storage capacity in addition to that currently planned during fiscal year 1982 and subsequent years. However, as discussed later in this chapter, DOE has not fully assessed alternatives to its current expansion plans.

DOE officials believe accelerating Phase II and Phase III is not a viable option

DOE's current Phase II and Phase III expansion plans come closest to a 300,000-barrels-per-day rate during fiscal year 1986, when DOE hopes to be able to receive about 82 million barrels of oil and achieve an average fill rate of 225,000 barrels per day. However, in previous and succeeding years, adequate new capacity will not be available to allow an average fill rate even as high as 225,000 barrels per day. Between fiscal years 1982 through 1989, current plans would allow DOE to achieve an average annual fill rate of 189,000 barrels per day.

DOE's July 1981 study states that DOE's schedule for a 750-million-barrel reserve cannot be accelerated to any significant degree. During our review, we asked DOE officials for additional information concerning the benefits and costs of accelerating Phase II and Phase III activities at Bryan Mound, West Hackberry, and the proposed Big Hill site.

According to DOE officials, to accelerate leaching at Bryan Mound and West Hackberry, an additional brine disposal pipeline would need to be built at each site. To build the new pipelines, DOE would need to conduct environmental impact studies, obtain permits, acquire additional rights-of-way, award contracts for construction and equipment, and increase the electricity available to each site. Based on the time required to build similar pipelines, DOE officials estimate these activities would take 4 to 5 years and cost about $200 million. These estimates were not documented and we were not able to verify the time or costs. If DOE were able to initiate these activities on October 1, 1982, and complete them in 4 years, DOE would be able to increase its leaching rate on October 1, 1986. However, according to DOE's schedule, leaching at Bryan Mound will be completed in February 1986. Although leaching at West Hackberry is scheduled to be completed in September 1987, the increased leaching capacity would

only enable DOE to increase its oil storage capacity at the site by 12 million barrels for fiscal year 1987. However, even this additional capacity would only allow DOE to increase its fill rate by about 33,000 barrels per day over the currently planned 200,000-barrels-per-day fiscal year 1987 fill rate. The total rate of 233,000 barrels per day still would be less than the suggested rate.

If the acceleration efforts took 5 years, DOE would be able to increase its leaching rate on October 1, 1987. However, if DOE adheres to its current expansion schedule, as noted above, it would have completed Phase II and Phase III leaching at both sites by September 1987. Thus, the additional pipelines would not be available in time to increase capacity substantially before the planned capacity at the sites is completed.

To accelerate development of the 140 million barrel Big Hill site planned for Phase III, DOE would have to accelerate acquisition of land for the site, drilling of wells, and the start of leaching at the site. DOE officials believe that acquiring land sooner than the October 1982 target date would involve land condemnations without preliminary negotiations to buy the land. If land acquisition were accelerated, DOE would also have to award a drilling contract during fiscal year 1982 to accelerate drilling at the site. DOE's plans now call for awarding the contract during October 1982 using fiscal year 1983 funds. DOE's fiscal year 1982 budget request included $103 million for Phase III to continue design, begin land acquisition, and acquire drilling equipment. DOE's fiscal year 1982 appropriation legislation provides about $99 million for these activities. Since funds to award a drilling contract were not included in the fiscal year 1982 budget request or appropriation legislation, DOE would need to request a supplemental appropriation or request approval to reprogram existing funds. DOE officials indicated they would need an additional $100 million in fiscal year 1982 funds to award a drilling contract during the fiscal year. Even if the Congress approves a supplemental appropriation or reprogramming of funds, it is unlikely that DOE would be able to advertise for bids and award a drilling contract more than a month or two before its currently planned October 1982 award date.

DOE options to accelerate SPR capacity

Table 4 shows the cost and projected storage capacity for DOE's planned 750-million-barrel SPR, and four alternative approaches discussed in its July 1981 report, on accelerating the availability of SPR storage capacity. Four of the five options discussed in the report involve increasing the size of the SPR above the 750-million-barrel capacity of Option 1, DOE's currently planned capacity. The schedules presented in the report assume that expansion activities start on October 1, 1981. Since this date has passed and the expansion activities have not

Table 4

DOE's Estimated Cost and Storage Capacity

Available Under SPR Expansion Options

Options	Cost			Available storage capacity at end of fiscal year (note a)						Equivalent average annual fill rate for fiscal years 1982 through 1989
	Facilities	Oil	Total	1984	1985	1986	1987	1988	1989	
	-(billions)			(millions of barrels)						-(barrels per day)-
1. DOE's Planned 750 million barrel system	$3.1	$37.4	$40.5	417	456	538	611	670	750	189,000
2. 790 million barrel system (Option 1 plus 40 million barrel Cote Blanche site)	3.3	39.5	42.8	435	496	578	651	710	790	202,000
3. 890 million barrel system (Option 2 plus 100 million barrels in steel tanks)	4.7	45.7	50.4	435	520	638	743	810	890	237,000
4. 1 billion barrel system (Option 3 plus 110 million barrel underground site)	5.7	54.1	59.8	435	520	638	743	824	b/950	257,000
5. 1 billion barrel system (Option 3 plus 110 million additional steel tank capacity)	6.2	53.0	59.2	435	520	662	803	904	1000	274,000

a/Storage capacity available at the end of fiscal year 1982 and 1983 are 267 million and 343 million barrels respectively under each option.

b/Storage capacity under this option would reach 1 billion barrels during fiscal year 1990.

Source: DOE's July 1981 SPR Acceleration Report to the Secretary of Energy.

been initiated, additions to capacity and fill rates will differ. As noted earlier, each option also assumes that DOE adheres to its schedule for completing a 750-million-barrel reserve.

Option 1, as noted, involves DOE's current schedules for completing the planned 750 million barrels of capacity. Under this option, the annual fill rate would average about 189,000 barrels per day until total capacity is reached in fiscal year 1989.

Option 2 consists of completing the currently planned 750-million-barrel capacity and acquiring another 40 million barrels of capacity at Cote Blanche, Louisiana, for a total capacity of 790 million barrels. Cote Blanche is an operating salt mine which DOE identified during the early stages of the program and considered during 1978 to 1979. DOE officials stated that DOE did not pursue acquiring the Cote Blanche site at that time because it suspended oil purchases in early 1979 and it was uncertain of the future availability of oil. Since DOE prepared an environmental impact study for this site as part of the previous assessment, and leaching is not necessary in a salt mine, 40 million barrels of additional capacity could be available in less time at Cote Blanche than at any other site considered. Increasing SPR capacity to 790 million barrels under this option would enable DOE to maintain an average fill rate of about 202,000 barrels per day through fiscal year 1989.

Option 3 involves adding the 40 million barrel Cote Blanche site to the currently planned capacity plus constructing 100 million barrels of above-ground steel tank capacity to achieve 890 million barrels of total capacity. Under this option, DOE would acquire three sites and construct steel tanks with 40 million barrels of capacity at one site and 30 million barrels at each of the two other sites. Undertaking this option would enable DOE to exceed the 300,000-barrels-per-day fill rate in fiscal year 1986 by filling at a rate of 323,000 barrels per day during the year. The average annual fill rate would increase to about 237,000 barrels per day through fiscal year 1989 under this option.

Option 4 consists of developing the capacity called for under Option 3 plus acquiring another site and developing additional underground storage caverns for about 110 million barrels of oil. This option would increase total SPR storage capacity to about 1 million barrels by fiscal year 1990. As with Option 3, this option enables DOE to reach a fill rate of 323,000 barrels per day in fiscal year 1986. It also allows DOE to fill at about 345,000 barrels per day in fiscal year 1989. DOE's fill rate would average about 257,000 barrels per day through fiscal year 1989 under this option.

Option 5 also involves developing the capacity called for under Option 3 but adds 110 million barrels of capacity through the construction of additional above-ground steel tanks. In addition to the sites that DOE would need to acquire for the

capacity associated with Option 3, this option would involve acquiring three more sites--two with 40 million barrels and one with 30 million barrels of capacity. This option would increase total SPR capacity to 1 billion barrels and enable DOE to exceed the 300,000-barrels-per-day fill rate in fiscal years 1986 and 1987 by averaging 389,000 and 387,000 barrels per day, respectively. DOE would be able to maintain an average annual fill rate of 274,000 barrels per day through fiscal year 1989 under this option.

A comparison of the capacity available under Options 4 and 5 shows that while capacity can be increased faster by constructing steel tanks than by developing a comparablely sized underground site, the underground site would cost less. However, it does not show the comparative costs and benefits of substituting above-ground steel tanks for some portion of the currently planned 750-million-barrel SPR or a reduced SPR size.

Effects of DOE options on SPR costs

Each of the options considered in DOE's July report would increase the cost of the SPR. As shown in table 4, developing the additional storage capacity associated with these options would increase SPR facilities' costs by $200 million under Option 2 to $3.3 billion. Under Option 5, facilities' costs would increase to about $6.2 billion which is double the cost of facilities for a 750-million-barrel reserve. Since Options 2 through 5 increase the size of the SPR, the additional oil required would increase costs by $2.1 billion under Option 2 to $16.7 billion under Option 4. Although Options 4 and 5 both call for 1 billion barrels of oil, Option 4 would be completed 1 year later, and DOE estimates that because of differences in the scheduled availability of storage capacity, the oil acquired under Option 4 would cost $1.1 billion more than the oil acquired under Option 5.

Additional option of leasing SPR storage space

DOE also may be able to lease existing storage capacity to increase the SPR's oil fill capability while long-term storage capacity is being developed. Existing capacity may be available in the form of above-ground steel tanks, underground caverns, or tankers. Although DOE discussed leasing storage space with several companies during the fall of 1981, DOE has not developed plans for leasing because it intends to fill the SPR at the average 189,000-barrels-per-day rate allowed for in current capacity expansion plans. DOE has not documented the costs and benefits of leasing additional storage space. However, DOE officials said that they are generally aware of the availability and cost of leasing storage space through informal contacts with industry. The DOE officials believe that DOE could lease between 10 million and 30 million barrels of capacity at a monthly cost of about 15 cents per barrel.

Based on the current expansion schedule for the 750-million-barrel reserve, DOE would need to lease from 42 million barrels in fiscal year 1982 to a maximum of 208 million barrels in fiscal year 1986 to fill the SPR at an average rate of 300,000 barrels per day. DOE officials expressed concern that, based on a 1979 National Petroleum Council report on "Petroleum Storage and Transportation Capacity", this volume of storage may not be available for leasing. The 1979 report stated that, as of September 30, 1978, no significant capacity existed in the petroleum industry's primary tanks and pipelines to hold emergency supplies of oil. However, we note that the statistics cited may not be relevant today. Because of time constraints of this review, we did not attempt to determine the volume of storage capacity that may be available for SPR leasing as of December 1, 1981.

CONCLUSIONS

During fiscal year 1981, availability of SPR storage capacity, oil acquisition funds, and oil supplies contributed to DOE's achievement of an average fill rate of 292,000 barrels per day. Under current plans, during the remainder of the 1980s, at best DOE will be able to achieve an average fill rate of 189,000 barrels per day. This assumes that DOE maintains its schedule for completing a 750-million-barrel SPR in 1989 and that funds are available to fill storage capacity as it becomes available.

It is too early to tell whether, during the next 8 years, DOE will maintain its 750-million-barrel expansion schedule. If current problems continue or additional problems arise so that DOE does not adhere to its expansion schedule, the average fill rate during fiscal years 1982 through 1989 will be less than the 189,000 barrels per day now planned. According to DOE officials, current Phase II and Phase III expansion plans cannot be reasonably accelerated because of key factors such as brine disposal rates and lead time requirements for land acquisition and major construction.

Although the 189,000 barrels-per-day rate exceeds the minimum fill rate requirement in the Energy Security Act, it will not meet the 300,000-barrels-per-day fill rate goal set forth in the Omnibus Budget Reconciliation Act. The only options DOE considered to achieve an average fill rate approaching 300,000 barrels per day each involve a decision to increase the size of the SPR. While DOE has taken action since our February 1981 report to increase the brine disposal rate at Bryan Mound, which would allow faster leaching at that site and has studied some options for further increasing the fill rate, DOE's actions have not ensured that adequate capacity will be available on a timely basis to meet the needs of an accelerated 300,000-barrels-per-day fill effort. Further, DOE's most recent efforts to analyze the costs, advantages, and disadvantages of an accelerated construction program assumed its current construction schedule and considered only those options which increase the size of the

reserve. It does not fully satisfy our earlier recommendation to report to the Congress on the costs, advantages, and disadvantages of an accelerated construction program and other storage options in part because it did not include a consideration of leasing temporary storage space. It also did not consider the costs and benefits of substituting above-ground steel tanks for some portion of the currently planned 750-million-barrel SPR or a reduced SPR size.

DOE may be able to lease existing storage space which could be used in combination with, or in place of, additional construction activities to supplement SPR storage capacity. DOE could purchase oil and fill leased storage space during the early 1980s and use this oil to fill the SPR during the late 1980s. DOE has discussed leasing space for temporary oil storage with several companies. However, it has not developed plans for leasing nor documented the costs and benefits of leasing because it intends to fill the SPR at the rate allowed by current expansion plans. DOE has not surveyed the extent of temporary storage which might be available.

If DOE is to ensure that adequate capacity is available on a timely basis consistent with congressional fill rate goals, it must have sufficient funds and an appropriate plan to provide the capacity needed. Depending on the size of the reserve, the desired fill rate, and funds provided through the congressional budget process, DOE may need to alter its current capacity expansion plans.

To assist the Congress in its deliberations over appropriate SPR funding levels, DOE should more fully assess the costs and benefits of alternatives to its current expansion plans which achieve an average fill rate of 300,000 barrels per day. This assessment should be made available to the Congress for its fiscal year 1983 budget deliberations. Based on further DOE assessment of options for achieving a 300,000-barrels-per-day fill rate and on the matters discussed in this report, the Congress may wish to reaffirm or provide new guidance on its desired SPR fill rate.

RECOMMENDATION

We recommend that the Secretary of Energy:

--Evaluate options for achieving an average annual fill rate of 300,000 barrels per day assuming the planned and other SPR sizes. The evaluation, which should be available for fiscal year 1983 congressional budget deliberations, should assess costs and benefits of alternatives to constructing new underground storage facilities, including such options as leasing temporary storage capacity.

MATTERS FOR CONSIDERATION BY THE CONGRESS

As part of the fiscal year 1983 budget process, the Congress should explore with the Department of Energy the matters discussed in this report regarding its current capacity expansion plans and options to achieve an average fill rate of 300,000 barrels per day until the SPR is filled. Based on its evaluation, the Congress should reaffirm or provide new guidance on its desired SPR fill rate.

CHAPTER 4

DOE PURCHASES HEAVIER CRUDES

The first oil acquisition plan and specifications for SPR crude oil quality were established in 1976. While many minor modifications were made within types of acceptable oils, the overall oil acquisition plan and quality specifications remained close to the original specifications during the first 4 years of the program. However, in October 1980 and in August 1981, DOE allowed the acquisition of substantial quantities of heavier crude oils.

This chapter discusses

--the rationale for the oil acquisition plan and 1976 specifications for SPR crude oil quality and

--two changes to the overall acquisition plan during fiscal year 1981 to accept heavier crudes.

BACKGROUND

In the event of a drawdown, SPR crude oil must be refined into petroleum products before it is used by consumers. U.S. refineries can produce a range of products, such as gasoline, kerosene and jet fuels, heating oil, lubricants, waxes, asphalt, and coke in descending order from lightest to heaviest. The proportion of these products varies with refinery design, market demand, and with the physical characteristics, or quality, of the crude oil used. The quality of the SPR oil, therefore, is an important determinant of the amount of specific petroleum products available to the Nation during an interruption.

The SPR oil quality can also affect which refiners would be able to use the oil. A refinery designed only to process light crude oil may not be able to refine the heavier SPR oil, unless sufficient supplies of light crude were available for blending. However, refineries designed to process heavier oil would have little difficulty refining either the light or heavy crude oil distributed from the SPR. In fact, if these refineries processed the light SPR oil, the more severe processing activities within some refineries, such as catalytic cracking, would result in a larger product yield of the lighter products, such as gasoline.

A 1980 National Petroleum Council report estimated that by 1982 only about 24 percent of U.S. refinery capacity will be devoted to processing heavy, medium- and high-sulfur crudes, 1/

1/The report defines heavy, medium-sulfur crude as having greater that 15 percent residuum assay at 1,050 degrees Fahrenheit and a total sulfur content of greater than 0.5 percent of weight.

including Alaskan North Slope (ANS) oil. Although the trend in refining capacity is moving toward processing more heavier, high-sulfur oils, the current ability of U.S. refineries to process the heavier crude oil now being purchased for the SPR is limited.

RATIONALE FOR 1976 SPR QUALITY SPECIFICATIONS

A 1976 report, prepared for the Federal Energy Administration (FEA), 1/ has formed the basis for the SPR oil quality specifications and the oil acquisition plan. The report surveyed about 80 types of crude available throughout the world. It assessed 1974 U.S. refinery capabilities and product demand and projected 1980 U.S. refining capabilities and product demand. The objective of the study was to determine the types of oil which, if stored in the SPR, would allow refiners to produce the same volume and mix of petroleum products during a hypothetical 1980 oil supply interruption as they would without the interruption.

The report grouped 23 major crude sources into six broad types that were acceptable for the SPR. The specifications for the six oil types, as modified slightly by FEA and DOE based on the changing status of oil availability, are shown in table 5. Overall, however, the six major types remained essentially intact. In addition, the report listed the quality characteristics of about 30 crudes which were unacceptable for the SPR. Among the reasons given were excessive high-sulfur content and residual yield, high oil viscosity, and limited availability of oil.

The Turner, Mason, and Solomon report used a refinery model to determine that a combination of two of the six types of crude--67 percent of Type I (intermediate gravity, high-sulfur oil) and 33 percent Type II (very light, low-sulfur oil)--would allow the SPR to respond to the supply interruption. The two crude oil types represented a trade-off between refinery needs and SPR crude oil acquisition costs. The study also indicated that during an interruption, if an emphasis were placed on production of distillate and residual fuel oil at the expense of lighter products such as motor gasoline, the preferred SPR crude oil quality mix would be 90 percent Type I and only 10 percent Type II. The study stated that this type of yield structure might be used if an interruption response strategy involved a severe limitation of gasoline usage through rationing.

In December 1976, FEA issued its SPR plan, which established the six acceptable crude types discussed above and a strategy specifying the mix of crudes to be purchased. FEA decided that about 60 percent of the crude oil to be stored in the SPR would

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1/Turner, Mason, and Solomon Consulting Engineers, "Composition of SPR Crude Oil Initial Analysis," prepared for FEA, Oct. 11, 1976.

Table 5

Quality Specifications and Yields of the Six Types of Crude Oil Acceptable for the SPR as of December 1, 1981 (note a)

Criteria	Type I intermediate, high-sulfur	Type II very light, low-sulfur, low mercaptan	Type III intermediate, low-sulfur, low mercaptan	Type IV light, low-sulfur, low mercaptan	Type V light, low-sulfur, high mercaptan	Type VI intermediate, intermediate-sulfur
API gravity (^{o}API)	30^{o} - 36^{o}	40^{o} - 45^{o}	30^{o} - 36^{o}	34^{o} - 40^{o}	36^{o} - 41^{o}	26^{o} - 30^{o}
Total sulfur content (% of weight)	1.99 max.	0.25 max.	0.50 max.	0.25 max.	0.50 max.	1.25 max.
Viscosity (note b)	150 max.	150 max.	150 max.	150 max.	150 max.	200 max.
Mercaptan (note c)	no limit	12 max.	12 max.	12 max.	No limit	No limit
Refinery yields (%)						
Naphtha	24 - 30	35 - 42	21 - 29	29 - 36	30 - 38	15 - 20
Distillate	17 - 31	21 - 35	23 - 37	31 - 45	19 - 33	24 - 27
Gas Oil	26 - 38	20 - 34	28 - 42	20 - 34	23 - 37	38 - 42
Residuals	10 - 19	4 - 9	7 - 14	0 - 5	7 - 14	15 - 20

a/Current quality specifications and yields reflect modifications to the 1976 FEA plan so that additional sources of oil, such as ANS and an Ecuadorian crude known as Oriente, and blends, would be acceptable for the SPR. For example, the lower limit of API gravity was reduced by 1 degree to 2 degrees for Types I, II, and VI and by 4 degrees for Type V; however, the lower limit was raised 1 degree for Type III (from 29 degrees to 30 degrees). The effect of the modifications to the quality specifications is to slightly reduce the acceptable refinery yields of naphtha, distillates, and gas oil.

b/Measures how much energy is needed to move a fluid. Generally, the higher the viscosity of the oil, the more energy is needed to move it through a pipeline.

c/Measures sulfur compounds in parts per million at 375 degrees to 500 degrees Fahrenheit.

Source: DFSC's January 1981 open continuous solicitation.

be Type I and 40 percent would be Types II, III, and IV oils (Types II, III, and IV are low-sulfur; however, Types III and IV although intermediate to light oils, are heavier oils than Type II oils.) Type V (high-quality oil, but the Turner report only identified two U.S. and one Libyan source of supply) and Type VI (lower sulfur, but heavier crude than Type I) were not included in its acquisition plan.

FEA stated in its 1976 plan that these crude oil specifications were selected to permit the SPR to provide replacement crude oil that would be acceptable to any refinery affected by an oil interruption. According to the FEA plan, only low-sulfur crude oil was acceptable to all refiners. However, because industry uses some products, such as fuel oil, which can have a high-sulfur content, a refinery would be processing better and, according to the plan, more expensive crude oil during an interruption than was needed to meet product specifications. FEA decided to store Type I crude oil in the SPR to reduce the cost of acquiring oil for the SPR, while still providing oils which refiners could use. FEA stated, however, that final decisions concerning the types of oil stored in the SPR would be affected by market availability and prices of the various types of crudes.

In 1978, a solicitation was issued which for the first time included Type V. DOE did not provide any documentation on the rationale for adding Type V to the acquisition strategy; however, a DOE official pointed to the availability of North Sea oil, much of which conforms to the revised Type V quality specifications. Because Type V crude is a high-quality oil, we note that it can provide a high percentage of lighter products and can be used by nearly all U.S. refineries.

DOE contract to update SPR oil quality specifications

While the 1976 SPR plan was a good first step in analyzing refinery capabilities and product needs, it is now out of date. According to DOE, since that time, many unforeseeable changes have occurred, particularly, (1) large increases in foreign crude oil prices have resulted in lower demand growth rates for most U.S. petroleum products and (2) Iran is no longer a dependable crude oil source for the Nation. These and other changes prompted DOE in May 1981 to award a $258,000 contract to William Brothers Engineering Company of Tulsa, Oklahoma, to update the 1976 study.

The objective of the study, according to the contract's statement of work, is to develop revised SPR crude oil and refined product storage mix specifications, which will form the basis for any revisions to DOE's acquisition strategy. DOE officials plan to accomplish this by having the contractor develop projections of refiners' 1985 capability to process light and heavy oils with varying sulfur contents. The contractor then will use a model to project refiners' 1985

production of petroleum products under 10 possible oil supply interruptions.

The study is scheduled to be completed in August 1982. In the meantime, DOE has made decisions to acquire lower quality oil that are not based on analyses of U.S. product needs and refinery capabilities.

OCTOBER 1980 DECISION TO ACCEPT TYPE VI CRUDES

DFSC's October 3, 1980, competitive exchange solicitation marked the first time that Type VI (26 to 30 degrees API gravity) oil was requested for the SPR. This allowed companies to offer ANS oil, which had come on-stream in June 1977, for the SPR.

As stated in our March 22, 1979, report, "Information on Department of Energy's Management of the Strategic Petroleum Reserve" (EMD-79-49), DOE did not acquire ANS oil before October 1980 because:

--The API gravity and expected refinery yields did not meet SPR specifications in use at the time (Types I through IV). ANS oil is about 26.5 degrees API gravity (about 3.5 degrees less than Type I crude) and generates less middle distillate products, such as kerosenes and jet fuels.

--A sufficient number of U.S. tankers did not exist to transport ANS oil to SPR sites. U.S. tankers have to be used to comply with the Merchant Marine Act of 1920 (P.L. 66-261), which requires that U.S. vessels be used to transport commodities between U.S. ports.

Concerning the rationale for the change in the SPR acquisition plan to include ANS crude, in October 1980, 1/ we reported that U.S. tankers were in sufficient supply and were being used to transport 500,000 barrels per day of ANS crude oil to the Gulf Coast refineries. We reported in our November 1980 status report, 2/ that the solicitation was amended because DFSC officials believed ANS crude was available on the market. Also, as stated previously, DOE had been only partially successful in meeting the minimum 100,000-barrels-per-day oil fill rate required by the Energy Security Act through its first competitive exchange solicitation. The first solicitation resulted in only 65,000 barrels per day. When DOE also allowed Type VI oil through its October 1980 supplemental solicitation, the remaining

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1/"Using Elk Hills and Alaskan North Slope Oil to Supply the Strategic Petroleum Reserve" (EMD-81-4, Oct. 21, 1980).

2/"Status of Strategic Petroleum Reserve Activities--October 1980" (EMD-81-24, Nov. 3, 1980)

35,000 barrels per day were achieved. Of this amount, 5.4 million barrels, or about 15,000 barrels per day, consisted of ANS oil.

The only documentation DOE provided us on the capability of refiners to process ANS oil was a DOE staff memorandum for the record dated October 3, 1980. The memo presents the staff's efforts to analyze the implications of storing ANS oil, and DOE officials said that it provides support for the purchase of ANS oil for the SPR. The memo stated that most refineries would have to blend ANS crude with other crudes before it could be satisfactorily processed. However, it also states that "* * * industry facing a crude shortage would take any crudes that the SPR could issue and effectively utilize them to make specific product slates." The memorandum gives some limited regional data on existing capacity and expansion plans; however, these data are insufficient to substantiate its claim that industry could effectively utilize ANS oil to yield specified product slates. Overall, the memo does not provide a sufficient analytical basis to justify changing the oil acquisition strategy.

Regarding product yields, the memorandum states that unblended ANS oil will yield a greater percentage of gasoline than Type I crude oils. The memo notes, however, that residual components would increase, and distillate fractions used for blending commercial jet fuels would substantially decrease.

We discussed ANS product yields with three refining industry officials. They stated that gasoline yields could be increased by processing naphtha and gas oils. However, they stated that to obtain gasoline from gas oil would require catalytic cracking equipment. Further, they believe that, given current capabilities, refineries would not be able to get higher yields of gasoline from ANS oil as compared to Type I crudes, such as Arabian lights.

1981 CONTRACT WITH PEMEX-- A NEW TYPE VIa

In July 1981, PEMEX offered to sell oil to the United States for the SPR. According to DFSC officials, PEMEX had recently lost customers because of its July increase in official selling price for Isthmus crude oil from $32 to $36 per barrel. Consequently, PEMEX offered to sell a blend of Isthmus, a Type I crude, and Maya, a low-quality crude, to DOE based on a selling price of $34 per barrel for the Isthmus crude.

In August 1981, a contract was signed for delivery to the SPR of 6 million barrels of Maya crude by December 31, 1981, and 104 million barrels of a blend of 60 percent Isthmus and 40 percent Maya crudes between September 1, 1981, and August 31, 1986. The 5-year contract represents the longest term commitment of oil to the SPR to date. As such, it provides a long-term supply from a secure source. DOE officials stated that, while high-quality world oil supplies have been available for much of the

year, DFSC has not been successful in getting long-term contracts. As an example, they point to DFSC's announcement on December 5, 1981, that in response to its solicitation, only one of the eight offers for long-term contracts met its price standards.

The price of the oil under the PEMEX contract was set at $28.50 per barrel for Maya crude and $31.80 per barrel for the Isthmus/Maya blend. Under terms of the contract, prices can be renegotiated each quarter at DOE or PEMEX request. We did not evaluate the reasonableness of the contract prices.

The Isthmus/Maya oil blend does not completely conform to quality specifications of Type I or Type VI oils. Consequently, DOE established a new Type--VIa. Maya crude by itself does not meet any of the SPR quality specifications. (See table 6.)

The minimum API gravity for the Maya crude is 22 degrees, which indicates it is a heavier crude than that allowed by the specifications. Type VI allows a low of 26 degrees API, and Type I crudes range from 30 degrees to 36 degrees API gravity. The sulfur content of Maya is 3.5 percent, which is 1.5 percentage points greater than the highest sulfur content acceptable under the specifications. Removing the higher sulfur content requires additional processing equipment, which many U.S. refiners do not have. The viscosity, a measure of the resistance of the oil to flow, for the Maya oil is 1,500. This means that Maya crude is more than 7 times more viscous than other oil accepted by the SPR, including Types VI and VIa oils.

The PEMEX contract allows up to 50 percent of the refinery yields for Maya to be residuals, such as coke and asphalt. This is 2-1/2 times higher than the 20 percent maximum for Type VI and about 2 times higher than the 23 percent allowed under the new Type VIa established to accommodate the contract.

In fact, the Maya crude is higher in sulfur and residual yield than 9 out of 11 crudes that the 1976 Turner, Mason, and Solomon report recommended not be stored in the SPR because of excessive high-sulfur and residual yields.

DOE did not furnish us any evidence that it considered the implications of the PEMEX contract's lower oil quality specifications on the SPR's ability to supply needed petroleum products during an oil supply interruption. While DOE officials told us that they discussed technical matters concerning the handling and processing of the Maya crude with some U.S. refiners which have handled the crude, they did not provide any documentation on the extent of U.S. refiners' capabilities to handle the Maya crude or the new Type VIa quality specification.

We talked with officials at the parent companies of 9 of the 24 U.S. refineries that used all of the Maya crude that was imported between June 1980 and July 1981. They confirmed the quality and yield limitations of Maya crude. The refineries which receive Maya crude generally have equipment to process

Table 6

Comparison of Sour Oil Quality Specifications and Yields
(DOE's Types I, VI, VIa, Crude Oils, and Maya Crude Oil)

	SPR Type I oil (includes Arab light oil, Mexican Isthmus oil)	SPR Type VI (includes Alaskan North Slope oil)	SPR Type VIa crude oil (blend specified in PEMEX contract)	Maya crude oil as specified in PEMEX contract
API gravity (^{o} API)	30^{o}-36^{o}	26^{o}-30^{o}	28^{o} min.	22^{o} min.
Total sulfur content (% of weight)	1.99% max.	1.25% max.	1.99% max.	3.5% max.
Viscosity	150 max.	200 max.	200 max.	1,500 max.
Refinery yields				
Naphtha	24-30%	15-20%	23% min.	10% min.
Distillate	17-31%	24-27%	22% min.	15% min.
Gas Oil	26-38%	38-42%	32% max.	20% min.
Residuals	10-19%	15-20%	23% max.	50% max.

Source: DOE, "SPR Annual Report," Feb. 16, 1980 and contract with PEMEX.

low-quality oils. The officials indicated that they use Maya crude to produce residual products, such as coke and asphalt. To counter the low-gravity, high-metals content, and high-sulfur content of Maya, the refineries blend it with other crudes.

According to DOE officials, DOE agreed to accept the 6 million barrels of Maya crude as part of its contract with PEMEX in order to obtain an assured long-term supply of the Type VIa blend. DOE and DFSC officials stated that, during July and August 1981, PEMEX contracts with foreign companies generally required 50 percent of the oil delivered to be heavier Mexican crudes.

In September 1981, DFSC received an unsolicited offer to sell 1.5 million barrels of the same (60/40) blend of Isthmus/ Maya crude to DFSC for the SPR at prices identical to the PEMEX contract. The offer was rejected by DFSC, based on DOE's technical evaluation. DOE officials stated that the open continuous solicitation did not include Type VIa and thus it was inappropriate to accept the offer. Further, DOE did not want to encourage more offers outside its specifications.

Changes to August 1981 contract

As discussed in our August 1981 status report, DOE officials initially expected that PEMEX would deliver a blend of 60 percent Isthmus oil and 40 percent Maya oil to meet the contract's specification for Type VIa oil. However, according to DOE officials, the 60/40 blend of Isthmus/Maya crude delivered during October 1981 did not meet the contract's specifications for the blend. As a result, DOE and PEMEX modified the contract in November 1981 to adjust the blend to 75 percent Isthmus and 25 percent Maya oil. The price of the blend was increased accordingly. The current price of $32.62 is based on the new ratio with $34 the price for Isthmus and $28.50 for Maya crude. On November 2, 1981, PEMEX increased the price for Isthmus oil from $34 to $35 per barrel. PEMEX's new price, however, does not apply to DOE's contract as currently modified.

As of December 1, 1981, DOE accepted for storage in the SPR about 1 million barrels of unblended Isthmus oil, 6.5 million barrels of unblended Maya oil, 4.5 million barrels of the 60/40 Isthmus/Maya blend, and 2.4 million barrels of the 75/25 blend for a total of about 14.4 million barrels under the PEMEX contract.

On December 11, 1981, DOE officials informed us that they have proposed a second modification to the PEMEX contract so that, after January 1, 1982, DOE will receive Isthmus and Maya oil unblended. Of the 86 million barrels scheduled to be delivered after January 1, 1982, DOE expects to receive about 65 million barrels of Isthmus and 21 million barrels of Maya crude.

In total, DOE officials expect to receive about 27 million barrels of the low-quality Maya crude and about 17 million barrels of the 60/40 and 75/25 blends of Isthmus and Maya crudes. DOE currently plans to store the Maya oil in Phase II and Phase III caverns at Bryan Mound separate from the unblended Isthmus oil delivered under the contract.

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By December 1, 1981, the SPR had received 223 million barrels of oil. Of that total, 40.3 million barrels, or 18 percent, were Types VI, VIa, or unblended Maya. In addition, on December 5, 1981, DOE awarded a contract to Atlantic Richfield Company for 2.14 million barrels of ANS oil to be delivered between April and October 1982. The extent that DOE has lowered or will lower the quality of oil for the SPR without adequate analysis will depend on future purchases, decisions on the final size of the SPR, and the results of DOE's ongoing study on the crude oil mix for the SPR.

CONCLUSIONS

While the 1976 SPR crude oil quality specifications and oil acquisition strategy were based on analysis of U.S. refiners' capabilities and product needs, 1980 and 1981 changes to the acquisition strategy and quality specifications which allowed purchase of heavier, lower quality oil, were not based on similar analysis. Although DOE awarded a $258,000 contract in May 1981 to perform such an analysis, the study will not be completed until August 1982. In the interim, DOE has continued to purchase lower quality oil without the needed analysis. The most recent example was the August 1981 PEMEX contract.

The heavier oils purchased during 1980-81, Types VI, VIa, and unblended Maya oil, currently comprise about 18 percent of the 223 million barrels in the SPR. Depending on the ultimate size of the reserve and the amount of heavier crude oil it contains, this percentage could change. Consequently, the likely impact on the mix of oil products which might be available during an oil supply interruption or on U.S. refiners' ability to process the oil is not known at this time.

RECOMMENDATIONS

We recommend that the Secretary of Energy:

--Emphasize crude oil quality in acquiring oil for the SPR under current specifications, to the extent that availability and prices of such crudes allow.

--Require that the Deputy Assistant Secretary for the SPR document the rationale for any future lowering of SPR oil quality specifications. Such documentation should address key reasons for the change, such as the availability and comparative costs of higher quality crude oils.

--Make a decision no later than September 30, 1982, on whether the quality specifications and acquisition strategy for SPR oil should be revised. The results of the ongoing studies of oil quality and the size of the reserve should be useful in making that determination.

APPENDIX I

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United States Senate

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, D.C. 20510

July 23, 1980

Honorable Elmer B. Staats
Comptroller General of the United States
GENERAL ACCOUNTING OFFICE
441 G Street, N.W.
Washington, D. C. 20548

Dear Mr. Staats:

On June 30, 1980 the President signed the Energy Security Act (Public Law 96-294). Title VIII of this Act is intended to provide for a resumption of purchases by the United States government of crude oil for the Strategic Petroleum Reserve authorized in 1975 by the Energy Policy and Conservation Act. Purchases of oil for this purpose have been suspended for well over a year, despite the fact that the present level of the SPR is clearly inadequate insurance against any contemplated interruption in petroleum imports.

The Congress attaches a high priority to the timely implementation of the provisions of title VIII. Both the language of the Act and the accompanying joint statement of managers are very emphatic on this matter. Accordingly, we are asking that you assist Congress in monitoring implementation of this title by the Executive Branch.

In particular we request that the General Accounting Office report by letter on a monthly basis to the Senate Committee on Energy and Natural Resources and the House Committee on Interstate and Foreign Commerce describing the activities taken by the Executive Branch under the provisions of title VIII of the Energy Security Act. This report should include GAO's evaluation of these activities in relation to the clear intent of Congress, expressed in the Act, to resume as soon as possible the filling of the SPR. These monthly reports should continue through October, 1981. We are further requesting that GAO provide Congress by January 1, 1982 with a comprehensive report on activities of the Executive Branch under title VIII for the period July, 1980 through October, 1981.

Please let us know if the Senate Committee on Energy and Natural Resources or the House Committee on Interstate and Foreign Commerce can be of assistance in carrying out this request.

Sincerely yours,

Harley O. Staggers
MEMBER OF CONGRESS

J. Bennett Johnston
U. S. SENATOR

John D. Dingell
MEMBER OF CONGRESS

Henry M. Jackson
U. S. SENATOR

James T. Broyhill
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Clarence J. Brown
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Bill Bradley
U. S. SENATOR

Mark O. Hatfield
U. S. SENATOR

Lowell P. Weicker, Jr.
U. S. SENATOR

SPR REPORTS ISSUED BY GAO

1. "Issues Needing Attention in Developing the Strategic Petroleum Reserve" (Feb. 16, 1977, EMD-77-20).

2. "Need to Minimize Risks of Using Salt Caverns for the Strategic Petroleum Reserve" (Jan. 9, 1978, EMD-78-25).

3. "Questionable Suitability of Certain Salt Caverns and Mines for the Strategic Petroleum Reserve" (Aug. 14, 1978, EMD-78-65).

4. "Acquisition of Royalty Oil for the Strategic Petroleum Reserve" (Oct. 6, 1978, EMD-79-1).

5. "Transportation Planning for the Strategic Petroleum Reserve Should Be Improved" (Oct. 18, 1978, LCD-78-211).

6. "Failure to Develop Adequate Data for the Regional Petroleum Reserves" (Mar. 20, 1979, EMD-79-14).

7. "Information on the Department of Energy's Management of the Strategic Petroleum Reserve" (Mar. 22, 1979, EMD-79-49).

8. "DOE's Management Control Procedures for Safeguarding the Reserve" (Mar. 27, 1979, EMD-79-42).

9. "Factors Influencing the Size of the U.S. Strategic Petroleum Reserve" (June 15, 1979, ID-79-8).

10. "U.S. Strategic Petroleum Reserve at a Turning Point--Management of Cost, Oil Supply Problems, and Future Site Development" (Jan. 2, 1980, EMD-80-19).

11. "Purchase Price of Strategic Petroleum Reserve Oil Fair, but Payment Timing Is Costly" (Apr. 3, 1980, PSAD-80-30).

12. "Status of Strategic Petroleum Reserve Activities" (Sept. 23, 1980, EMD-80-127).

13. "Using Elk Hills and Alaskan Northern Slope Oil to Supply the Strategic Petroleum Reserve" (Oct. 21, 1980, EMD-81-4).

14. "Status of Strategic Petroleum Reserve Activities--October 1980" (Nov. 3, 1980, EMD-81-24).

15. "Status of Strategic Petroleum Reserve Activities--December 1980" (Dec. 22, 1980, EMD-81-37).

16. "Status of Strategic Petroleum Reserve Activities--February 1981" (Feb. 24, 1981, EMD-81-49).

17. "Status of Strategic Petroleum Reserve Activities--April 1981" (May 4, 1981, EMD-81-25).

18. "Status of Strategic Petroleum Reserve Activities--June 1981" (June 19, 1981, EMD-81-107).

19. "Status of Strategic Petroleum Reserve Activities--July 1981" (July 20, 1981, EMD-81-118).

20. "Status of Strategic Petroleum Reserve Activities--August 1981" (Aug. 28, 1981, EMD-81-136).

21. "The United States Remains Unprepared for Oil Import Disruptions" (Sept. 29, 1981, EMD-81-117).

22. "Status of Strategic Petroleum Reserve Activities--September 1981" (Oct. 2, 1981, EMD-82-7).

APPENDIX III

TABLES ON FISCAL YEAR 1981 SPR OIL CONTRACTS, RECEIPTS, AND STORAGE CAPACITY

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Table 1

Contracts Awarded Under Competition

Exchange of Naval Petroleum Reserve Oil

	Date of award	Barrels to be exchanged	Daily fill rates	Type of oil (note a)	Total price paid (note b)	First proposed delivery date	Last proposed delivery date
First Solicitation:		(millions)			($/barrel)		
Atlantic Richfield Company	9-18-80	1.5	4,110	Sour	32.62	9-80	12-80
	9-18-80	2.1	5,890	Sweet	34.62 - 35.42		
	10-01-80	5.7	15,671	Sweet	34.62 - 36.42	9-80	12-80
Getty Oil Company	10-01-80	1.8	5,000	Sweet	36.78	1-81	10-81
Coastal States Trading Company	10-01-80	5.5	15,000	Sweet	37.19 - 38.40	10-80	3-81
Chevron Oil Company	10-01-80	7.3	20,000	Sweet	37.66	11-80	3-81
Subtotal		23.9	65,671				
Supplemental Solicitation:							
Chevron Oil Company	10-31-80	3.4	9,178	Sour	29.06	12-80	9-81
USA Petroleum Chemical Corp.	10-31-80	2.0	5,507	Sour	33.92	12-80	6-81
Derby and Co., Inc.	10-24-80	3.4	9,178	Sweet	37.37 - 38.12	11-80	3-81
Derby and Co., Inc. (note c)	10-31-80	4.0	10,831	Sweet	37.37 - 38.12	11-80	4-81
Subtotal		12.8	34,694				
Total		36.7	100,365				

a/Oil quality is measured, among other things, by sulfur content. Sour crude is defined by DOE as crude having between 0.5 percent and 1.99 percent sulfur. Sweet crude has less than 0.5 percent sulfur.

b/Total of NPR oil value and total premium paid.

c/This award represents additional oil to be exchanged by Derby and Co., Inc. However, it is considered part of DFSC's October 24, 1980, contract with the company.

Source: Defense Fuel Supply Center

APPENDIX III

Table 2

Contracts Awarded Under January 1981

Open Continuous Solicitation

Contract date	Supplier	Total barrels to be delivered (note a) (millions)	Annualized daily fill rate	Type of oil (note b)	Delivery dates First	Delivery dates Last
Fiscal year 1981 delivery:						
2/13/81	Amoco Oil Co.	.7	1,918	Sweet	5/81	5/81
2/13/81	Derby & Co., Inc.	7.6	20,822	Sweet	3/81	6/81
		8.2	22,466	Sour	4/81	6/81
2/20/81	British Petroleum Oil Development, LTD	5.2	14,247	Sweet	4/81	6/81
2/20/81	Motor Oil Hellas	.9	2,466	Sweet	3/81	3/81
3/06/81	Houston Oil and Refining, Inc.	3.4	9,315	Sweet	5/81	7/81
		1.5	4,110	Sour	6/81	6/81
3/06/81	Listo Energy, Inc.	.6	1,644	Sweet	4/81	5/81
		1.0	2,740	Sour	5/81	6/81
3/10/81	Coral Petroleum, Inc.	2.0	5,479	Sweet	4/81	5/81
3/13/81	Coastal States Trading, Inc.	.7	1,918	Sweet	7/81	8/81
		.6	1,644	Sour	3/81	4/81
3/31/81	Amerada Hess Corp.	2.0	5,479	Sweet	6/81	6/81
3/31/81	U.S. and S.A. Enterprises, Inc.	4.2	11,507	Sour	4/81	5/81
6/09/81	U.S. and S.A. Enterprises, Inc.	.8	2,192	Sweet	6/81	8/81
6/09/81	Exxon	3.0	8,219	Sour	7/81	7/81
6/09/81	Chevron	.7	1,918	Sour	7/81	8/81
6/09/81	Conoco	1.0	2,740	Sweet	8/81	8/81
6/26/81	Derby & Co., Inc.	.9	2,466	Sweet	7/81	7/81
		2.7	7,397	Sour	7/81	8/81
6/26/81	Houston Oil and Refining	1.0	2,740	Sour	7/81	8/81
6/26/81	U.S. and S.A. Enterprises, Inc.	1.0	2,740	Sour	7/81	8/81
6/26/81	Coastal Bermuda	1.0	2,740	Sour	7/81	7/81
6/26/81	Amoco Oil Co.	.8	2,192	Sour	7/81	7/81
6/26/81	Exxon International	.55	1,507	Sweet	7/81	7/81
6/26/81	Listo Energy	.55	1,507	Sweet	8/81	8/81
6/26/81	Texaco U.S.A.	.5	1,370	Sour	7/81	7/81
7/10/81	Mobil Oil Corp.	1.9	5,205	Sour	7/81	8/81
7/10/81	Exxon U.S.A.	1.5	4,110	Sour	7/81	8/81

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7/10/81	Exxon International	1.0	2,740	Sweet	8/81	8/81
7/10/81	Texaco U.S.A.	.8	2,192	Sour	8/81	8/81
7/21/81	Texaco International	3 0	8,219	Sour	8/81	9/81
8/05/81	Exxon International	2.3	6,301	Sour	9/81	9/81
8/05/81	Derby & Co., Inc.	.7	1,918	Sour	9/81	9/81
8/19/81	Exxon U.S.A.	1.0	2,740	Sour	9/81	9/81
8/19/81	Derby & Co., Inc.	.4	1,096	Sweet	9/81	9/81
		.5	1,370	Sour	9/81	9/81
8/19/81	Arco Petroleum Products	.4	1,096	Sour	9/81	9/81
8/19/81	Coastal States Trading, Inc.	.2	548	Sweet	8/81	8/81
Subtotal		66.8	c/ 183,014			
Fiscal year 1982 delivery:						
9/01/81	Exxon International	6.0	16,438	Sour	10/81	10/81
9/01/81	Derby & Co., Inc.	1.6	4,384	Sour	10/81	10/81
		.4	1,096	Sweet	10/81	10/81
9/15/81	Derby & Co., Inc.	.9	2,466	Sour	10/81	10/81
		.1	274	Sour	10/81	10/81
9/29/81	Exxon International	3.3	9,041	Sour	10/81	10/81
10/13/81	Derby & Co., Inc.	.4	1,096	Sour	11/81	11/81
11/25/81	U.S. and S.A. Enterprises, Inc.	.6	1,644	Sour	12/81	1/81
11/25/81	Derby & Co., Inc.	1.1	3,014	Sweet	12/81	12/81
		.4	1,095	Sweet	12/81	12/81
		.5	1,370	Sour	12/81	1/82
Subtotal		15.3	41,918			
Total		82.1	224,932			

a/Rounded to the nearest hundred thousand for the basic contract awarded on the date indicated and subsequent modifications.

b/Sweet crude for the SPR is defined as having less than 0.5 percent sulfur content, sour crude is defined as having between 0.5 percent and 1.99 percent sulfur content.

c/This represents the total volume awarded under fiscal year 1981 contracts divided by 365 days. Because of rounding, the column adds to 183,018 barrels per day.

Source: Defense Fuel Supply Center

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Table 3

Volume of SPR Oil Stored in Caverns and Other Facilities

GAO reporting period	Volume of oil at start of period	Deliveries	Volume of oil at end of period	Average receiving rate For reporting period	Average receiving rate Since 10/01/80
	(millions of barrels)			(barrels per day)	
10/01/80 to 9/30/81	92.8	a/ 106.5	199.3	291,781	291,781
10/1/81 to 12/01/81	199.3	b/ 23.5	222.8	379,987	304,450

a/DOE completed receiving the first shipment of oil resulting from the fiscal year 1981 competitive exchange on September 23, 1980.

a/Deliveries include 641,490 barrels of Elk Hills Naval Petroleum Reserve oil delivered to the SPR via pipeline by Pacific Refining Company.

b/Deliveries include 258,067 of Alaskan North Slope (ANS) oil delivered to the SPR by Chevron Oil Company as a result of an October 2, 1981, settlement with the Government. According to the settlement, Chevron will deliver about $33 million worth of ANS oil to the SPR. Based on an estimated price of about $33 per barrel, DOE expects to receive a total of about 1 million barrels of ANS oil under the settlement.

Source: Department of Energy

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(306276)

Table 4

Status of Phase I SPR Storage Capacity

As of December 1, 1981

SPR site	Capacity constructed (note a)	Capacity ready to use (note b)	Volume of oil in underground storage as of 12/1/81	DOE's estimated completion date for additional capacity	Brief description of work to be done
	(millions of barrels)				
Weeks Island, LA	75.0	75.0	52.0	Completed	None
Bayou Choctaw, LA	43.8	43.8	41.6	Completed	None
Sulphur Mines, LA	25.6	12.5	7.6	January 1982--13.1 million barrels	Cavern being tested for pressure losses. Potential pressure losses to be repaired and above-ground piping to be connected.
West Hackberry, LA	48.9	48.9	47.8	Completed	None
Bryan Mound, TX	64.5	64.5	64.4	Completed	None
Total	257.8	244.7	c/ 213.4		

a/DOE estimates of storage capacity based on November 3, 1981, sonar tests and calculations by Texas Brine Corporation.

b/Storage facilities certified ready to receive oil.

c/Additional 9.4 million barrels of oil is in pipelines, tanks, and Phase II storage caverns. This brings total oil in the SPR system to 222.8 million barrels. About 6.7 million of the 9.4 million barrels is designated for Phase II storage facilities.

Source: Department of Energy

APPENDIX III